# Technical Appendix:

# Section 3. BMP Effectiveness

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## TA-3. BMP Effectiveness

### SPA property maps

#### Four SPAs in Montgomery County

The locations of the four Special Protection Areas in Montgomery County are provided in Figure TA-3.1. Land use change in the Clarksburg SPA far exceeds that of the other three SPAs (Fig. TA-3.2). The Gateway 270 Corporate Center (denoted in gray) comprises three monitoring projects (Gateway 270, Gateway 270 West, Gateway 270 Lot 7). Hurley Ridge was developed prior to establishment of the SPA and there has been no construction or monitoring on the LCor property. No monitoring has been conducted on the Clarksburg High School and Rocky Hill Middle School properties.

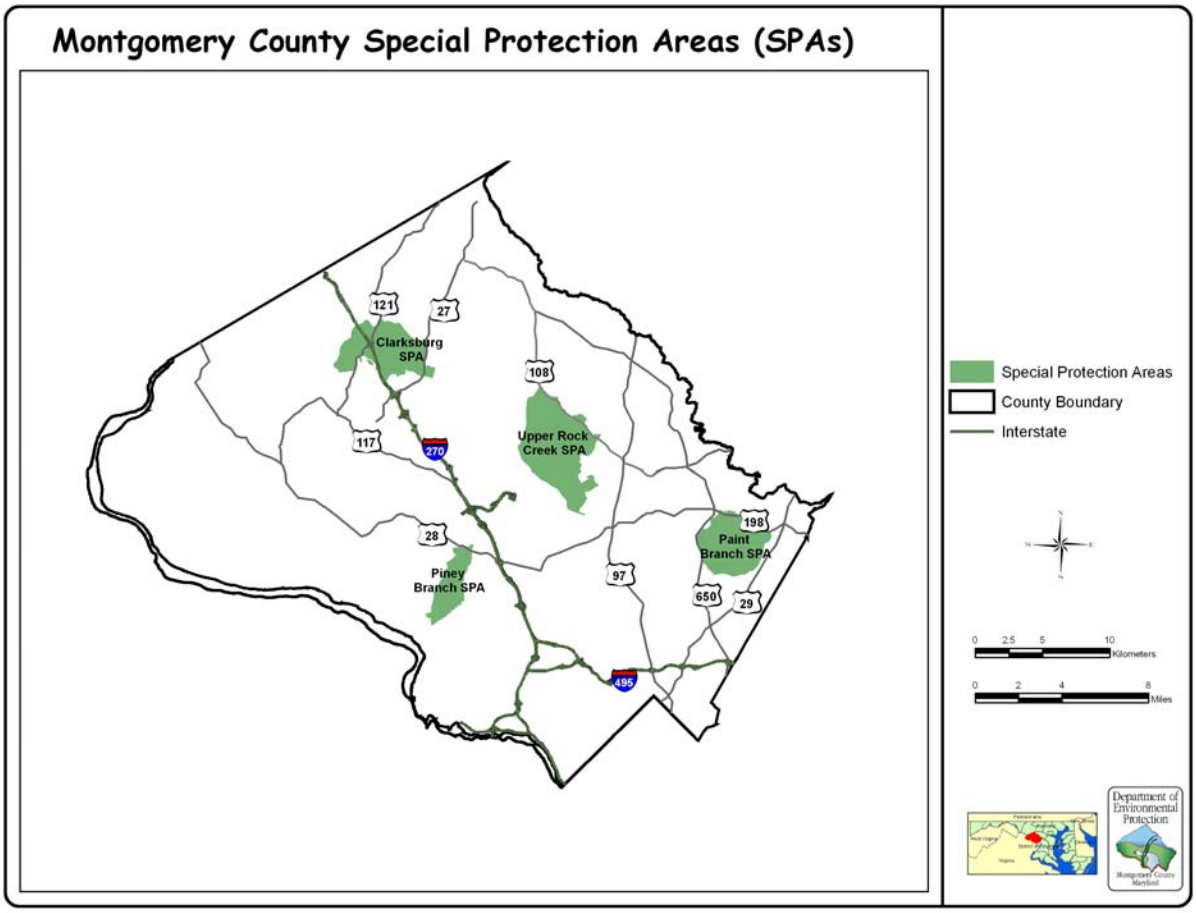


**Figure TA-3.1. Location of the four Special Protection Areas (SPAs) in Montgomery County.**

Construction of new development projects in the Paint Branch SPA has occurred mostly on the Right Fork subwatershed (Fig. TA-3.3). One project, Peach Orchard/Allnutt, was turned over to the State Highway Administration as part of a mitigation package for the Intercounty Connector.

The Piney Branch SPA (Fig. TA-3.4) is near the maximum build-out allowed under the Master Plan. Analysis conducted in 2005 by the MNCPPC found that five percent, or 121 acres of the 2,369 total acres in the Piney Branch SPA remain available for development (MCDEP 2008). Two large projects, Willows of Potomac and Piney Glen Village, underwent development prior to establishment of the SPA requirements. These developments, which lack special land use controls and water quality protection, cover approximately 433 acres.

A portion of the Upper Rock Creek watershed was designated as a Special Protection Area in the Olney Master Plan adopted in February 2004. The SPA includes the entire Upper Rock Creek watershed north of Muncaster Mill Road and west of Rock Creek North Branch (Fig. TA-3.5). Only Casey at Bowie Mill / Preserve at Rock Creek Preserve at Rock Creek and Freeman Property / Reserve at Fair Hill are being monitored. During construction monitoring at the Reserve at Fair Hill began in 2007. The Preserve at Rock Creek has been monitored to establish baseline conditions. No development or monitoring has occurred on the Hendry Property.

**Clarksburg SPA Properties**

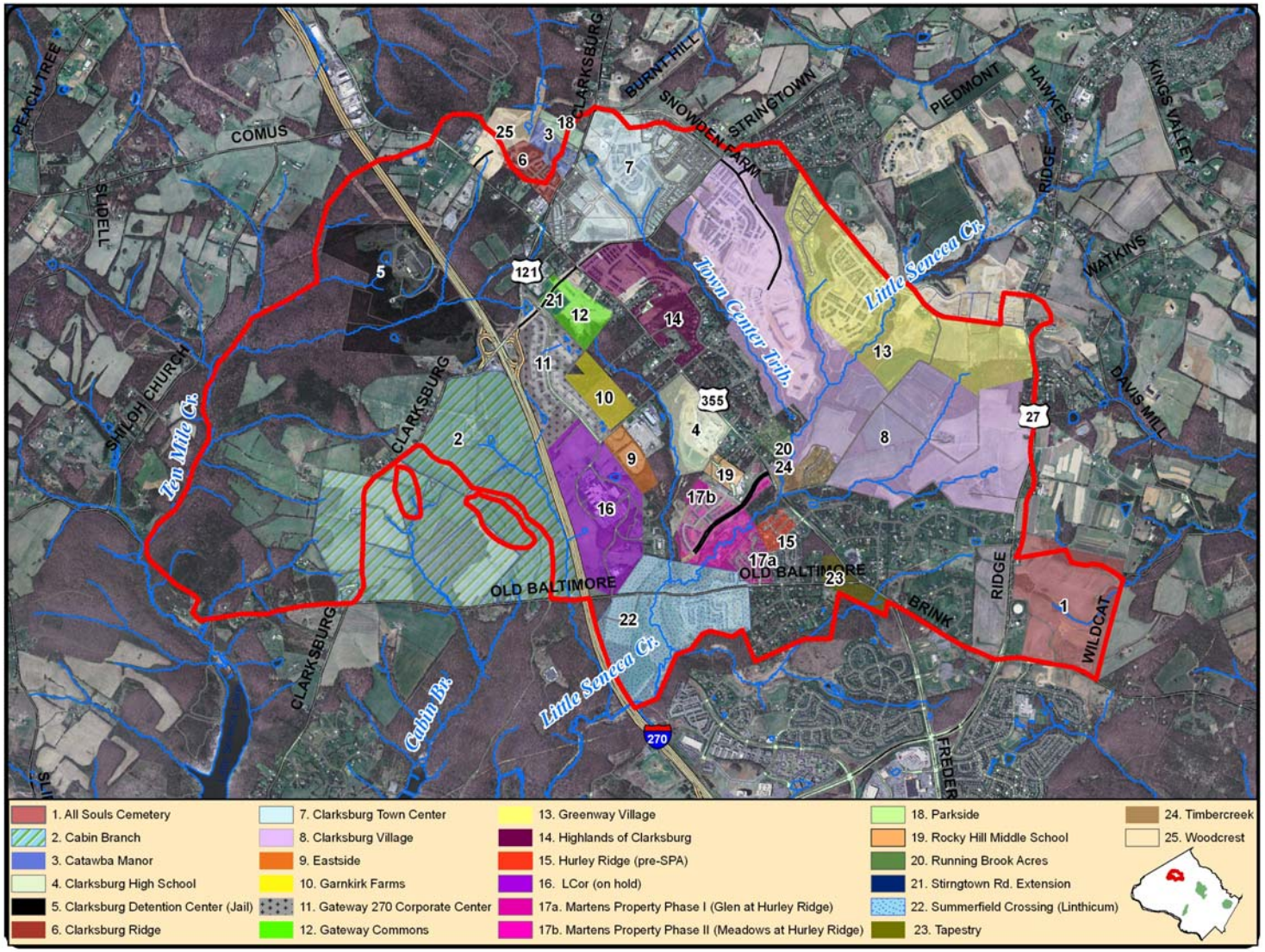


**Figure TA-3.2. Development activities in the Clarksburg SPA.**

**Paint Branch SPA Properties**

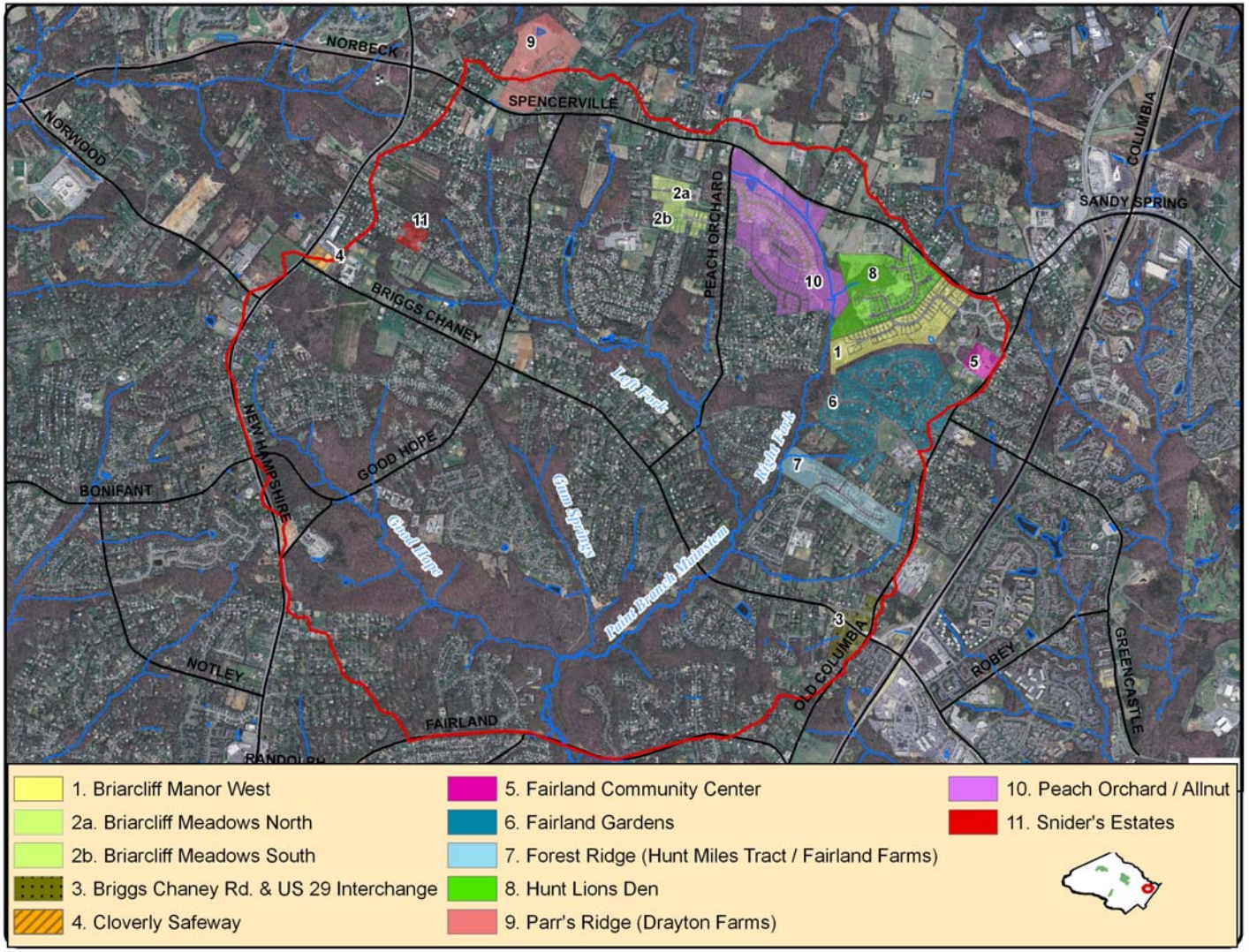


**Figure TA-3.3. Paint Branch SPA properties.**

**Piney Branch SPA Properties**

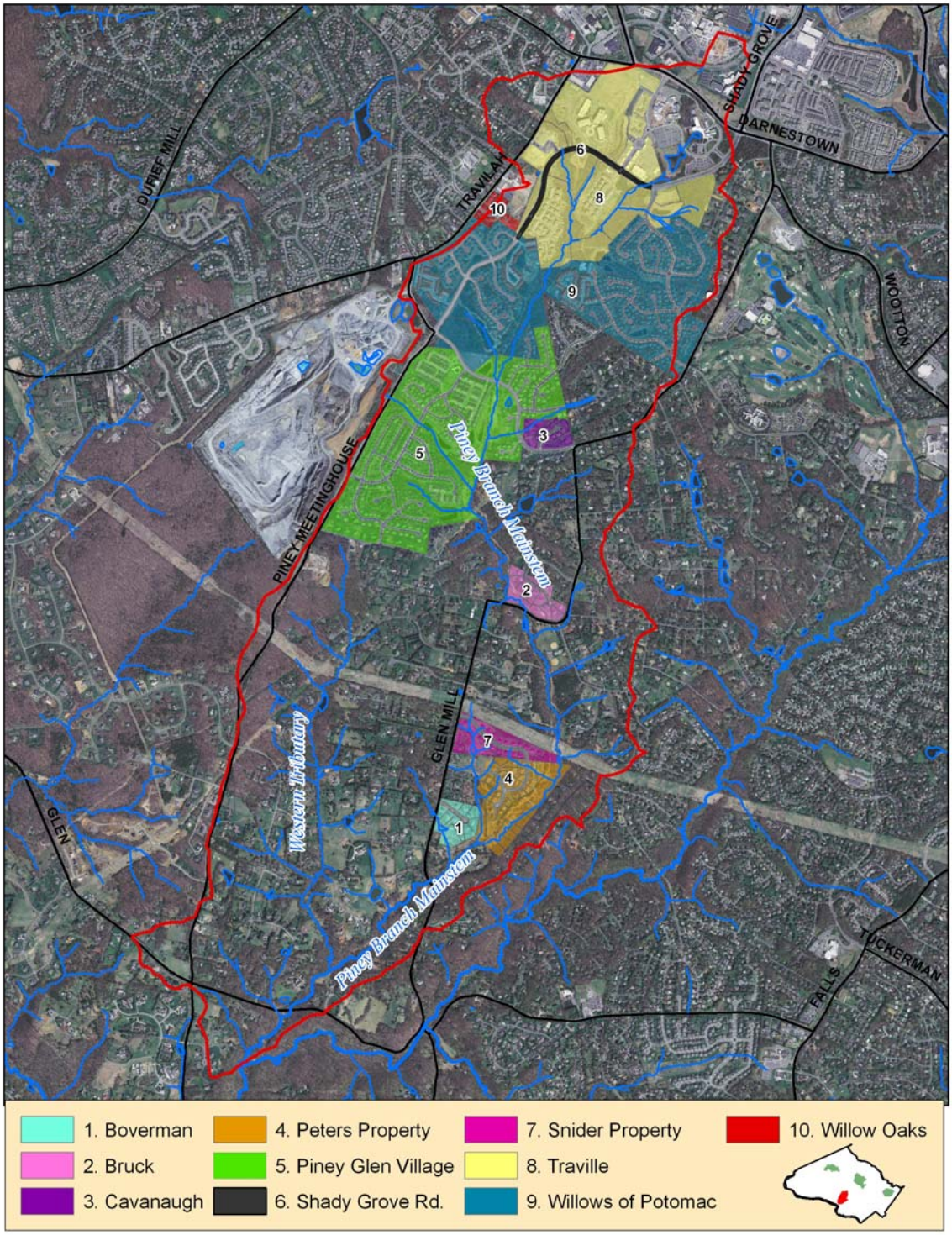


**Figure TA-3.4. Piney Branch SPA properties.** Piney Glen Village and Willows of Potomac were developed prior to establishment of SPA requirements.

**Upper Rock Creek SPA Properties**

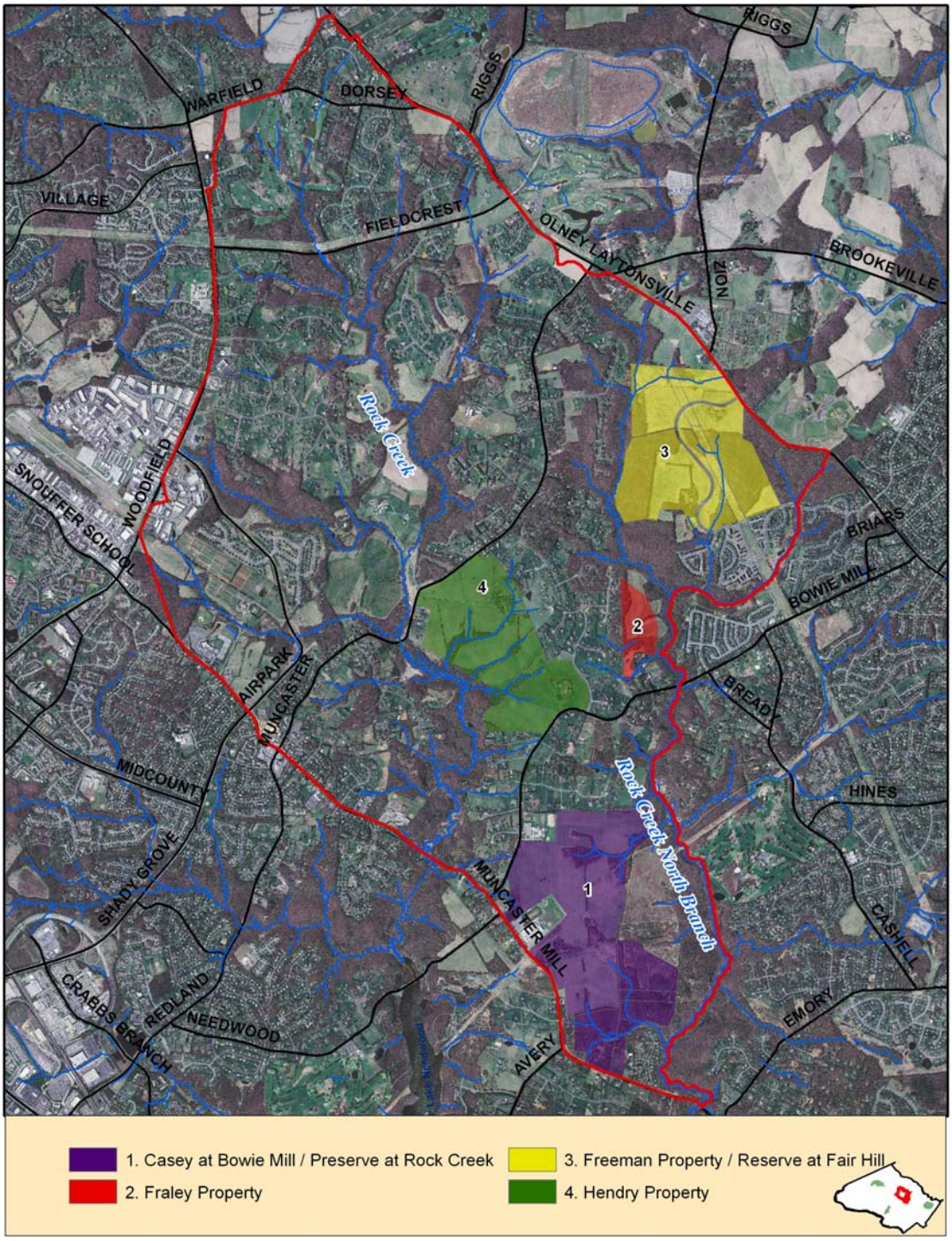


**Figure TA-3.5. Upper Rock Creek SPA showing large developable parcels.** No development or monitoring has occurred on the Hendry Property.

## SPA projects and BMP monitoring requirements

A list of all properties with SPA BMP monitoring is provided in Table TA-3.1. The first part of the table provides structural monitoring requirements; the second part of the table provides monitoring requirements for other parameters.

**Table TA-3.1. SPA project status with monitoring requirements.** If structural monitoring was required, the type of sampling – grab or automated – is specified. "Automated" denotes that flow-weighted composite samples were collected using automated sampling equipment.

| SPA | No. | Project Name | Monitoring Phase (during 2007) | Structural Monitoring | |
|---|---|---|---|---|---|
| | | | | S&EC Structure | SWM Structure |
| Clarksburg | 1 | All Souls Cemetery | Post Construction | No | No |
| | 2 | Cabin Branch | Pre-construction | Yes - Automated | Yes - Automated |
| | 3 | Catawba Manor | Post Construction | No | No |
| | 4 | Clarksburg Detention Center (Jail) | Complete (2003) | Yes - Grab | No - Requirement dropped |
| | 5 | Clarksburg Ridge | During Construction | Yes - Grab | Yes - Automated |
| | 6 | Clarksburg Town Center | During Construction | Yes - Automated | Yes - Automated |
| | 7 | Clarksburg Village (w/Greenway Trail) | During Construction | Yes - Grab | Yes - Automated; 3 structures |
| | 8 | Eastside | Pre-construction | Yes - Automated | Yes - Automated |
| | 9 | Garnkirk Farms | Pre-construction | Yes - Automated | Yes - Automated |
| | 10 | Gateway 270 | Complete (2003) | No | No |
| | 11 | Gateway 270 Lot 7 | Complete (2005) | No | No |
| | 12 | Gateway 270 West | Complete (2004) | No | Yes - Automated; existing pond outfall |
| | 13 | Gateway Commons | During Construction | Yes - Automated | Yes - Automated |
| | 14 | Greenway Village | During Construction | Yes - Grab&Auto (2 structures) | Yes - Automated; 2 structures |
| | 15 | Highlands at Clarksburg | During Construction | Yes - Grab | Yes - Automated |
| | 16 | Martens [a] | During Construction | Yes - Grab | Yes |
| | 17 | Parkside | During Construction | Yes - Grab | No - Not required |
| | 18 | Running Brook Acres | Post Construction | Yes - Grab | Yes - Automated * |
| | 19 | Stringtown Road Extension | During Construction | Yes - Automated | Yes - Automated |
| | 20 | Summerfield Crossing [b] | During Construction | No - Requirement dropped | Yes - Automated |
| | 21 | Tapestry | Pre-construction | Yes - Automated | Yes - Automated |
| | 22 | Timbercreek | Post Construction | No | No |
| | 23 | Woodcrest | During Construction | Yes-Grab&Auto | Yes - Automated |

| | | | | | |
|---|---|---|---|---|---|
| Paint Branch | 24 | Briarcliff Manor West | Complete (2006) | No | No |
| | 25 | Briarcliff Meadows North & South | During Construction | No | Yes - Automated; 2 structures |
| | 26 | Briggs Chaney Rd. | Post Construction | Yes - Grab; outfall only | Yes - Grab; outfall only |
| | 27 | Cloverly Safeway | Post Construction | No | Yes - Automated |
| | 28 | Fairland Community Center | Complete (2003) | No | No |
| | 29 | Fairland Gardens | Complete (2000) | No | No |
| | 30 | Forest Ridge [c] | Post Construction | Yes - Grab | No |
| | 31 | Hunt Lions Den | Post Construction | No | No |
| | 32 | Parr's Ridge [d] | Complete (2005) | No | No |
| | 33 | Snider's Estates | Post Construction | Yes - Grab | Yes - Automated |
| Piney Branch | 34 | Boverman | Complete (2004) | No | No |
| | 35 | Bruck | Complete (2003) | No | No |
| | 36 | Cavanaugh | Complete (2003) | No | No |
| | 37 | Peters Property | Complete (2004) | No | No |
| | 38 | Shady Grove Rd. | Complete (2002) | No | No |
| | 39 | Snider Property | Complete (2005) | Yes - Grab; outfall only | Yes - Grab; outfall only |
| | 40 | Traville | During Construction | Yes - Grab | Yes - Automated |
| | 41 | Willow Oaks | Post Construction | Yes - Grab | Yes - Automated |
| Upper Rock Creek | 42 | Casey @ Bowie Mill [e] | Pre-construction | No | Yes - Automated; 2 structures |
| | 43 | Freeman [f] | During Construction | No | Yes - Automated; 3 structures |

[a] Martens Property is divided into two phases, which are now called Glen at Hurley Ridge (Phase I) and the Meadows at Hurley Ridge (Phase II).

[b] Summerfield Property is also referred to as Lithicum Property.

[c] Forest Ridge is also known as Hunt Miles Tract or Fairland Farms

[d] Parr's Ridge was previously known as Drayton Farms

[e] Casey @ Bowie Mill is also known as Preserve at Rock Creek.

[f] Freeman Property is also known as Reserve at Fair Hill

* Automated (flow-weighted composite) sampling required, but some grab samples have been obtained instead.

**Table TA-3.1. (continued). SPA projects with monitoring requirements.** Numbers beneath headings indicate the number of stations monitored for the specified parameter.

| SPA | No. | Project Name | Other Monitoring Requirements | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GW[a] Level | GW[a] Chem | Stream WQ[b] | Discrete Stream Flow | Cont-inuous Stream Flow | Cross-Sections | Embedded-ness | Stream Profile | Temperature | Photos | Rain |
| Clarksburg | 1 | All Souls Cemetery | | | | | | 2 | | | 1 | | |
| | 2 | Cabin Branch | 5 | 4 | 1 | | | 10 | | | 2 | | |
| | 3 | Catawba Manor | 1 | | | | | | | | | | |
| | 4 | Clarksburg Detention Center (Jail) | 3 | 3 | | | 1 | | | | 1 | | 1 |
| | 5 | Clarksburg Ridge | | | | | | | | | | | |
| | 6 | Clarksburg Town Center | | | 3 | | 1 | | | | 3 | | 1 |
| | 7 | Clarksburg Village (w/Greenway Trail) | 18 | 9 | 1 | 6 | 2 | 10 | 6 | | 7 | | 1 |
| | 8 | Eastside | 1 | | | | | 3 | | 1 | | 1 | 1 |
| | 9 | Garnkirk Farms | 2 | | | | | | | | | | |
| | 10 | Gateway 270 | | | | | | | | | 4 | | |
| | 11 | Gateway 270 Lot 7 | | | | | | | | | | 1 | |
| | 12 | Gateway 270 West | | | | | | | | | | | |
| | 13 | Gateway Commons | 3 | | | | 1 | 3 | | | | | |
| | 14 | Greenway Village | 7 | | 1 | 3 | 1 | 3 | 3 | | 1 | | |
| | 15 | Highlands at Clarksburg | 5 | | | | | | 1 | | 2 | 1 | |
| | 16 | Martens | 4 | | | | | | | | 2 | | |
| | 17 | Parkside | 3 | | | | | | | | 1 | 1 | |
| | 18 | Running Brook Acres | | | | | | | 1 | | | | |
| | 19 | Stringtown Road Extension | | | | | | | | | | | |
| | 20 | Summerfield Crossing | 5 | | 2 | 1 | | | 2 | | 5 | | |
| | 21 | Tapestry | 2 | | | | | 3 | | | | | |
| | 22 | Timbercreek | 2 | | | | | | | | 2 | | |
| | 23 | Woodcrest | 4 | 4 | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Paint Branch | 24 | Briarcliff Manor West | 1 | | | | 1 | 1 | 2 | | 3 | | |
| | 25 | Briarcliff Meadows North & South | 4 | 4 | | | | | | | | | |
| | 26 | Briggs Chaney Rd. | | | | | | | | | | | |
| | 27 | Cloverly Safeway | | | | | | | | | 1 | | |
| | 28 | Fairland Community Center | 2 | | | | | | | | 3 | 1 | |
| | 29 | Fairland Gardens | | | | | 1 | | | | | | |
| | 30 | Forest Ridge | 4 | | | | | 3 | 1 | | 2 | 1 | 1 |
| | 31 | Hunt Lions Den | 3 | | | | | 5 | 1 | | 2 | | |
| | 32 | Parr's Ridge | 1 | | | | | | | | | | |
| | 33 | Snider's Estates | | | 1 | | | | | | | | |
| Piney Branch | 34 | Boverman | 1 | 1 | | | | | 1 | | 1 | | |
| | 35 | Bruck | | | | | | | 1 | | 2 | | |
| | 36 | Cavanaugh | 2 | | | | | | 1 | | 3 | | |
| | 37 | Peters Property | | | | | 1 | | 2 | | 2 | 1 | |
| | 38 | Shady Grove Rd. | | | | | | | 4 | | | | |
| | 39 | Snider Property | | | 1 | | | | | | | 1 | |
| | 40 | Traville | 1 | | 1 | | 1 | 3 | 1 | | 2 | | |
| | 41 | Willow Oaks | | | | | | | | | | | |
| Upper Rock Creek | 42 | Casey @ Bowie Mill | 4 | 4 | | | | | | 3 | | | |
| | 43 | Freeman | 4 | 4 | | | | 2 | | 2 | | | 1 |

[a] GW = Groundwater
[b] WQ = Water Quality; also known as “instream chemistry”.

## TA-3.1. Water Quality Monitoring
### Completed projects and monitoring dates

Monitoring dates and requirements for completed projects are provided in Table TA-3.2. Table TA-3.2 is also split into two parts: the first part displays years of monitoring and structural monitoring requirements; the second part lists number of stations monitored for other parameters.

**Table TA-3.2. Years of monitoring and data collected for completed SPA projects.**

| | | | | Structural Monitoring | |
|---|---|---|---|---|---|
| **SPA** | **Project Name** | **Year Monitoring Began** | **Year Monitoring Completed** | **S&EC Structure** | **SWM Structure** |
| Clarksburg | Clarksburg Detention Center (Jail) | 1997 | 2003 | Yes - Grab | No- requirement dropped |
| Clarksburg | Gateway 270 | 1999 | 2003 | No | No |
| Clarksburg | Gateway 270 Lot 7 | 2003 | 2005 | No | No |
| Clarksburg | Gateway 270 West | 1999 | 2003 | No | Yes - grab; existing pond outfall |
| Paint Branch | Briarcliff Manor West /Baldi | 1998 | 2006 | No | No |
| Paint Branch | Fairland Community Center | 1998 | 2003 | No | No |
| Paint Branch | Fairland Gardens | 1997 | 2000 | No | No |
| Paint Branch | Parr's Ridge (Drayton Farms) | 1997 | 2005 | No | No |
| Piney Branch | Boverman | 1998 | 2004 | No | No |
| Piney Branch | Bruck | 1998 | 2003 | No | No |
| Piney Branch | Cavanaugh | 1998 | 2003 | No | No |
| Piney Branch | Peters Property | 1998 | 2004 | No | No |
| Piney Branch | Shady Grove Rd. | 1997 | 2002 | No | No |
| Piney Branch | Snider Property | 2000 | 2005 | Yes - Grab; outfall only | Yes - Grab; outfall only |

**Table 3.2. (continued). Years of monitoring and data collected for completed SPA projects.** Numbers beneath headings indicate the number of stations monitored for the specified parameter.

| | | Other Monitoring Requirements | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPA | Project Name | GW[a] Lvl. | GW[a] Chem | Stream WQ[b] | Discrete Stream Flow | Cont-inuous Stream Flow | Cross-Section | Embedded-ness | Stream Profile | Temperature | Photo | Rain |
| Clarksburg | Clarksburg Detention Center (Jail) | 3 | 3 | | | 1 | | | | 1 | | 1 |
| Clarksburg | Gateway 270 | | | | | | | | | 4 | | |
| Clarksburg | Gateway 270 Lot 7 | | | | | | | | | | 1 | |
| Clarksburg | Gateway 270 West | | | | | | | | | | | |
| Paint Branch | Briarcliff Manor West /Baldi | 1 | | | | 1 | 1 | 2 | | 3 | | |
| Paint Branch | Fairland Community Center | 2 | | | | | | | | 3 | 1 | |
| Paint Branch | Fairland Gardens | | | | | 1 | | | | | | |
| Paint Branch | Parr's Ridge (Drayton Farms) | 1 | | | | | | | | | | |
| Piney Branch | Boverman | 1 | 1 | | | | | 1 | | 1 | | |
| Piney Branch | Bruck | | | | | | | 1 | | 2 | | |
| Piney Branch | Cavanaugh | 2 | | | | | | 1 | | 3 | | |
| Piney Branch | Peters Property | | | | | 1 | | 2 | | 2 | 1 | |
| Piney Branch | Shady Grove Rd. | | | | | | | 4 | | | | |
| Piney Branch | Snider Property | | | 1 | | | | | | | 1 | |

[a] GW = Groundwater

[b] WQ = Water Quality; also known as “instream chemistry”.

### TA-3.1.1 Stream Temperature

Stream water temperature is a very important factor in maintaining the biological health of streams. SPA BMP design features that help minimize temperature impacts include: 1) requiring enhanced stream buffers and reforestation, 2) minimizing imperviousness, 3) using dry ponds for runoff quantity control to avoid standing pools that soak up excessive heat, 4) promoting infiltration using roadside swales and other infiltration structures, and 5) using sand filters and bio-filtration cells which cool warm water as it filters through sand and soil.

Stream temperature is logged continuously from June 1 through September 30 at a minimum of 24-minute intervals. It is monitored before development through the post-construction period to evaluate if BMPs meet performance goals by mitigating thermal impacts.

### TA-3.1.2 Embeddedness

Embeddedness is monitored to evaluate the amount of sediment covering the stream bottom. SPA BMP monitoring of embeddedness documents existing in-stream fine sediment loads in riffle habitats and records changes in these fine sediment loads before, during, and after BMP installation. Quarterly data collection is most often required. Monitoring is in accordance with Montgomery County Department of Environmental Protection Protocols (1998).

### TA-3.1.3 Groundwater Levels

Groundwater levels are monitored to determine if there are impacts to groundwater levels and stream baseflow as a result of the development process. Furthermore, many SPA BMPs are designed to promote infiltration, so groundwater levels are often monitored upstream and downstream of the SWM facility. Discrete or continuous groundwater levels can be collected.

### TA-3.1.4 Groundwater Chemistry

In addition to affecting surface water, stormwater discharges may affect groundwater quality. The value of stormwater monitoring alone can be limited when assessing compliance with groundwater quality standards since stormwater quality is likely to change substantially while percolating through soils (Geosyntec Consultants and UWRRC 2002). Monitoring of groundwater chemistry in SPAs is often done quarterly. Values are compared to Maryland water quality standards where values exist.

Three wells were monitored at Clarksburg Detention Center for the chemical parameters provided in Table TA-3.3. Nine samples were collected from November 1997 through September 2002. Pre-development monitoring was to last for six months, during construction monitoring until the site was stabilized and sediment control ponds were converted to stormwater management, and post-construction for three years.

**Table TA-3.3. Chemical parameters, methods, and reporting limits for groundwater chemistry monitoring at the Clarksburg Detention Center (Clarksburg SPA).**

| Parameter | Unit | Method | Detection Limit |
|---|---|---|---|
| Ammonia | mg/L | MCAWW 350.3 [+] | 0.100 |
| Nitrate | mg/L | MCAWW 353.2 | 2.50 |
| Total Kjeldahl Nitrogen | mg/L | MCAWW 351.3 | 0.100 |
| Total Phosphorous | mg/L | MCAWW 365.2 | 0.200 |
| Ortho-Phosphorous | mg/L | MCAWW 365.2 | 0.010 |
| Specific Conductance | umhos/cm | MCAWW 120.1 | 1.00 |
| pH | pH | MCAWW 150.1 | 0.010 |

[+] MCAWW - Methods for Chemical Analysis of Water and Wastes

One well was monitored twice a year at the Boverman Property in the Piney Branch SPA for groundwater chemistry (Table TA-3.4). 10 samples were collected from July 1999 through October 2003.

**Table TA-3.4. Chemical parameters, methods, and detection limits for groundwater chemistry monitoring at the Boverman Property (Piney Branch SPA).**

| Parameter | Unit | Method | PQL [#] |
|---|---|---|---|
| Nitrate | mg/L | EPA 300.0 | 0.2 |
| Nitrite | mg/L | EPA 300.0 | 0.2 |
| Total Kjeldahl Nitrogen | mg/L | EPA 351.1 | 0.2 |
| Phosphorus | mg/L | EPA 365.3 | 0.05 |

[#] Practical Quantitation Limit

### TA-3.1.5 Instream Chemistry

Stream chemistry was monitored on the Snider Property at one station on Sheep's Run near the outfall of SWM pond #1. Sheeps Run intersects the property and joins the Piney Branch just downstream of the Snider Property. Pre-construction monitoring began August 2000 with construction monitoring commencing December 2000. Post-construction began January 2003 and was required for three years. Grab sample data for stream chemistry monitoring at Sheep's Run is presented in Table TA-3.5.

**Table TA-3.5. Stream chemistry monitoring at Sheep's Run on the Snider Property (Piney Branch SPA).**

| Monitoring Period | Sample Date | TKN (mg/L) | Nitrate (mg/L) | Nitrite (mg/L) | TSS (mg/L) | Ortho-P (mg/L) | TP (mg/L) |
|---|---|---|---|---|---|---|---|
| | 8/30/2000 | 1.6 | 1.2 | ND* | 43.0 | 0.9 | 1.0 |
| | 9/27/2000 | 2.6 | 0.6 | 0.1 | 26.0 | 1.0 | 1.4 |
| **Pre** | 10/11/2000 | 1.4 | 4.5 | ND* | 6.0 | 0.6 | 2.0 |
| | 5/8/2001 | 2.4 | 1.1 | ND* | 35.0 | 0.2 | 0.7 |
| | 7/31/2001 | 1.0 | 0.9 | No Sample | 16.0 | No Sample | 0.3 |
| | 10/25/2001 | 1.0 | 1.0 | No Sample | 1.0 | No Sample | 2.1 |
| | 10/8/2002 | 1.1 | 0.3 | ND* | 9.0 | 0.7 | 2.2 |
| **During** | 11/5/2002 | 0.6 | .03** | | 7.0 | 1.3 | 1.5 |
| | 5/27/2003 | 2.6 | 1.2 | ND* | 7.0 | 1.1 | 5.5 |
| | 10/14/2003 | 1.0 | 1.5 | ND* | 12.0 | 0.6 | 5.0 |
| | 6/16/2004 | 0.8 | 0.7** | | 17.0 | ND* | ND* |
| | 8/4/2004 | ND* | 0.6** | | 17.0 | ND* | ND* |
| | 9/21/2004 | 0.8 | 0.3** | | 16.0 | ND* | No Sample |
| | 6/9/2005 | ND* | 1.1 | ND* | 18.4 | ND* | ND* |
| | 8/3/2005 | 1.0 | 1.0 | ND* | 12.4 | ND* | No Sample |
| **Post** | 10/4/2005 | 0.5 | 0.7 | ND* | 46.4 | ND* | No Sample |

*Note: ND means Not Detected; results are less than the Practical Quantitation Limit (PQL).

The PQL for TKN is 0.1mg/L, for nitrate and nitrite 0.2mg/L, for ortho phosphate 0.1mg/L, and for TP 0.05mg/L.

**Note: Laboratory did not analyze sample for nitrate and nitrite separately, but rather combined them.

Additional Note: Property owner did not allow access to property for monitoring until October in 2002.

November monitoring was added for an additional data set. Access was also denied in July 2003.

Monitoring normally occurs in spring, summer, and fall of each year.

### TA-3.1.6 Continuous Stream Flow

There are no technical appendix materials for this section.

## TA-3.2. Sediment and Erosion Control (S&EC) BMP Monitoring

### Evaluation of BMP efficiency using percent removal

Using percent removal to evaluate BMP efficiency is a controversial topic. Two articles are most helpful regarding the topic: one that presents BMP efficiency in terms of percent removal (CWP 2007) and one that contests its use (Geosyntec Consultants and Wright Water Engineers 2007).

Copies of these documents are available online:

www.stormwater.net – Center for Watershed Protection. 2007. National pollutant removal performance database: version 3. (CWP 2007)

www.bmpdatabase.org – Frequently Asked Questions: Why does the International Stormwater BMP Database Project omit percent removal as a measure of BMP performance? (Geosyntec Consultants, Wright Water Engineers, Inc. 2007.)

Another document consulted when selecting the appropriate method to evaluate BMP efficiency can be located here:

http://www.bmpdatabase.org/docs/Urban%20Stormwater%20BMP%20Performance%20Monitoring.pdf – Urban Stormwater BMP Performance Monitoring: A Guidance Manual for Meeting the NationalStormwater BMP Database Requirements (Geosyntec Consultants and UWRRC 2002).

### TA-3.2.1. Grab Samples

101 total suspended solids (TSS) grab samples were collected and considered in efficiency analysis (Table TA-3.6).

**Table TA-3.6. Total suspended solid (TSS) grab sample data used to calculate median removal efficiency.** A negative percent reduction indicates that more of a pollutant is leaving the system than is entering.

| SPA | Project | Date Built | Sample Date | Structure Age (mo.) | Rainfall (in.) | TSS Concentration (mg/L) Forebay | Main Cell | Outfall | Pollutant Reduction (%) |
|---|---|---|---|---|---|---|---|---|---|
| Clarksburg | Clarksburg Gateway System | | 09/29/2004 | | | 121.36 | 180.00 | 264.00 | -117.54% |
| | | | 12/10/2004 | | | 150.40 | 140.00 | 266.00 | -76.86% |
| | | | 02/15/2005 | | | 29.21 | 32.00 | 30.00 | -2.72% |
| | | | 06/23/2005 | | | 45.62 | 5.40 | 11.80 | 74.14% |
| | | | 09/15/2005 | | | 65.00 | 84.00 | 0.00 | 100.00% |
| | | | 10/25/2005 | | | 93.03 | 81.00 | 83.00 | 10.78% |
| | | | 04/04/2006 | | 0.4 | 134.00 | 386.00 | 139.00 | -3.73% |
| | | | 05/12/2006 | | 0.9 | 230.54 | 328.00 | 106.00 | 54.02% |
| | | | 09/06/2006 | | 1.2 | 14.04 | 46.40 | 96.00 | -583.59% |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 10/18/2006 | | 0.7 | 9.24 | 7.60 | 25.20 | -172.85% |
| | | | 02/26/2007 | | 0.7 | 23.77 | 23.20 | 34.20 | |
| | | | 06/04/2007 | | 0.5 | 1.40 | 1.00 | 4.00 | |
| | | | 08/21/2007 | | 0.6 | 14.50 | 8.00 | 4.00 | |
| | | | 11/16/2007 | | 0.6 | 12.93 | 13.00 | 1.00 | |
| | Clarksburg Ridge | | 04/12/2004 | 11 | 1.3 | 369.00 | NA | 81.80 | 77.83% |
| | | | 07/07/2004 | 14 | 1.2 | 236.00 | NA | 23.20 | 90.17% |
| | | | 08/02/2004 | 15 | 0.0 | 102.00 | NA | 30.00 | 70.59% |
| | Clarksburg Village - Basin 'A' | 03/01/2004 | 04/01/2004 | 1 | 1.5 | 406.67 | 300.00 | 53.33 | 86.89% |
| | | | 07/08/2004 | 4 | 0.6 | 72.00 | 26.00 | 0.00 | 100.00% |
| | | | 09/09/2004 | 6 | 0.5 | 125.00 | 32.50 | 0.00 | 100.00% |
| | | | 09/18/2004 | 6 | 1.8 | 96.67 | 220.00 | 213.33 | -120.68% |
| | | | 02/15/2005 | 12 | 0.5 | 53.33 | 24.00 | 27.33 | 48.75% |
| | | | 03/23/2005 | 13 | 1.3 | 357.00 | 317.00 | 284.67 | 20.26% |
| | | | 07/06/2005 | 16 | 0.8 | 95.00 | 125.00 | 78.33 | 17.55% |
| | | | 10/07/2005 | 19 | 1.0 | 25.33 | 176.00 | 146.67 | -479.04% |
| | | | 10/25/2005 | 20 | 1.1 | 2.00 | 38.67 | 10.00 | -400.00% |
| | | | 05/11/2006 | | 0.9 | 20.00 | 66.67 | 33.33 | -66.65% |
| | | | 06/26/2006 | | 2.0 | 2.23 | 2.67 | 5.80 | -160.09% |
| | | | 09/01/2006 | | 1.4 | 3.27 | 2.27 | 3.17 | 3.06% |
| | | | 09/05/2006 | | 1.2 | 7.73 | 4.46 | 18.00 | -132.86% |
| | Clarksburg Village - Basin 'B' | 10/01/2003 | 04/01/2004 | 6 | 1.5 | 243.00 | 47.33 | 33.33 | 86.28% |
| | | | 07/08/2004 | 9 | 0.6 | 176.00 | 110.00 | 6.00 | 96.59% |
| | | | 09/09/2004 | 11 | 0.5 | 21.50 | 4.00 | 1.50 | 93.02% |
| | | | 09/18/2004 | 11 | 1.8 | 131.30 | 121.67 | 12.67 | 90.35% |
| | | | 02/15/2005 | 17 | 0.5 | 28.67 | 19.33 | 8.67 | 69.76% |
| | | | 03/23/2005 | 18 | 1.3 | 78.67 | 123.60 | 29.33 | 62.72% |
| | | | 07/06/2005 | 21 | 0.8 | 222.50 | 110.00 | 6.67 | 97.00% |
| | | | 10/07/2005 | 24 | 1.0 | 315.33 | 159.33 | 146.67 | 53.49% |
| | | | 10/25/2005 | 25 | 1.1 | 30.67 | 18.00 | 42.67 | -39.13% |
| | | | 05/11/2006 | | 0.9 | 93.33 | 60.00 | 0.00 | 100.00% |
| | | | 06/26/2006 | | 2.0 | 33.78 | 2.23 | 3.10 | 90.82% |
| | | | 09/01/2006 | | 1.4 | 281.50 | 3.43 | 0.17 | 99.94% |
| | | | 09/05/2006 | | 1.2 | 29.88 | 8.03 | 13.00 | 56.49% |
| | Clarksburg Village - Basin 'D' | | 08/21/2007 | | 0.9 | 2.00 | 11.33 | 7.83 | |
| | | | 09/11/2007 | | 0.4 | 3.67 | 5.67 | 0.00 | |
| | | | 09/28/2007 | | 0.6 | 1.77 | 5.33 | 4.00 | |
| | | | 11/27/2007 | | 0.6 | 0.23 | 8.33 | 7.90 | |
| | Clarksburg Village - Basin 'F' | | 08/21/2007 | | 0.9 | 68.94 | 23.67 | 3.00 | |
| | | | 09/11/2007 | | 0.4 | 10.22 | 6.67 | 6.67 | |
| | | | 09/28/2007 | | 0.6 | 9.69 | 6.00 | 3.77 | |
| | | | 10/26/2007 | | 0.8 | 184.59 | 28.00 | 18.23 | |
| | Greenway Village Sed. Trap #5 | 03/01/2004 | 06/29/2005 | 16 | 0.6 | 46.20 | | 30.00 | |
| | | | 07/08/2005 | 16 | 2.5 | 109.33 | | 150.00 | |
| | | | 07/15/2005 | 16 | 0.7 | 30.00 | | 60.00 | |
| | | | 10/08/2005 | 19 | 2.0 | 17.33 | | 60.00 | |
| | | | 09/05/2006 | | 1.4 | 8.80 | | 7.80 | |
| | | | 09/14/2006 | | 0.7 | 3.33 | | 5.00 | |
| | | | 10/17/2006 | | 0.9 | 23.83 | | 46.70 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Greenway Village Sed. Trap #7/7A | 03/01/2006 | 08/20/2007 | 17 | 1.1 | 144.50 | | 9.00 | 93.77% |
| | | | 10/26/2007 | 19 | 1.6 | 578.00 | | 46.00 | 92.04% |
| | Martens Basins 1 & 3 | 06/06/2003 | 03/18/2004 | 9 | 0.2 | 20.00 | 14.00 | 4.60 | 77.00% |
| | | | 06/14/2004 | 12 | 0.8 | 15.00 | 17.00 | 4.00 | 73.33% |
| | | | 09/29/2004 | 16 | 2.1 | 80.00 | 160.00 | 156.00 | -95.00% |
| | | | 12/10/2004 | 18 | 1.0 | 15.00 | 32.00 | 80.00 | -433.33% |
| | | | 02/15/2005 | 20 | 0.5 | 8.40 | 33.00 | 41.00 | -388.10% |
| | | | 06/23/2005 | 25 | 0.4 | 11.35 | 10.80 | 4.80 | 57.71% |
| | | | 05/12/2006 | | 0.9 | 94.00 | 104.00 | 73.00 | 22.34% |
| | | | 09/06/2006 | | 1.2 | 54.00 | 39.60 | 38.40 | 28.89% |
| | | | 10/18/2006 | | 0.7 | 14.80 | 9.60 | 8.40 | 43.24% |
| | Martens Traps B1 & B2 | | 02/26/2007 | | 0.7 | 274.00 | 48.00 | 18.20 | |
| | | | 06/04/2007 | | 0.5 | 0.00 | 10.00 | 27.00 | |
| | | | 08/21/2007 | | 0.6 | 6.00 | 27.00 | 83.00 | |
| | Parkside Cell #1 & Cell #2 | 02/01/2004 | 09/17/2004 | 8 | 1.3 | 250.00 | | 330.00 | -32.00% |
| | | | 09/28/2004 | 8 | 1.8 | 170.00 | | 120.00 | 29.41% |
| | | | 06/30/2005 | 17 | 0.6 | 5.00 | | 5.00 | 0.00% |
| | | | 07/15/2005 | 17 | 0.8 | 8.00 | | 4.00 | 50.00% |
| | Running Brook | | 03/26/2002 | 2 | 0.6 | 23.00 | 19.00 | 18.00 | 21.74% |
| | | | 06/07/2002 | 4 | 0.3 | 58.00 | 21.00 | 12.00 | 79.31% |
| | | | 10/11/2002 | 8 | 1.6 | 100.00 | 48.00 | 104.00 | -4.00% |
| | | | 02/04/2003 | 12 | 0.4 | 520.00 | 428.00 | 226.00 | 56.54% |
| | | | 05/16/2003 | 15 | 0.9 | 110.00 | 53.00 | 410.00 | -272.73% |
| | | | 09/03/2003 | 19 | 0.3 | 110.00 | 8.50 | 8.00 | 92.73% |
| | Woodcrest | | 09/05/2006 | | 1.6 | 598.00 | | 922.00 | -54.18% |
| | | | 09/14/2006 | | 0.8 | 154.00 | | 254.00 | -65.00% |
| | | | 10/17/2006 | | 1.1 | 222.00 | | 384.00 | -73.00% |
| | | | 08/20/2007 | | 1.0 | 138.00 | | 90.00 | 35.00% |
| **Paint Branch** | Forest Ridge Cells #1 & #2 | 07/01/2003 | 09/03/2003 | 2 | 0.1 | 120.00 | 31.00 | 0.00 | 100.00% |
| | | | 09/04/2003 | 2 | 0.4 | 400.00 | 28.00 | 0.00 | 100.00% |
| | | | 09/23/2003 | 3 | 2.1 | 356.00 | 203.00 | 80.00 | 77.53% |
| | | | 04/01/2004 | 9 | 1.5 | 140.00 | 22.00 | 5.00 | 96.43% |
| | | | 04/13/2004 | 9 | 1.4 | 60.00 | 199.00 | 82.00 | -36.67% |
| | | | 07/08/2004 | 12 | 0.8 | 132.00 | 16.00 | 8.00 | 93.94% |
| | | | 09/09/2004 | 14 | 0.4 | 136.00 | 4.00 | 25.30 | 81.40% |
| | | | 09/18/2004 | 14 | 1.2 | 230.00 | 110.00 | 0.00 | 100.00% |
| | | | 02/15/2005 | 20 | 0.5 | 6.00 | 12.00 | 16.00 | -166.67% |
| | | | 03/23/2005 | 21 | 2.1 | 32.00 | 12.00 | 158.00 | -393.75% |
| | | | 07/08/2005 | 24 | 2.9 | 12.00 | 88.00 | 102.00 | -750.00% |
| **Piney Branch** | Snider's Estates | | 04/12/2004 | 11 | 1.3 | 100.00 | 94.00 | 46.00 | 54.00% |
| | | | 04/24/2004 | 12 | 0.7 | 53.00 | 7.00 | 13.00 | 75.47% |
| | | | 05/18/2004 | 12 | 1.0 | 21.00 | 10.00 | 9.00 | 57.14% |
| | | | 07/22/2004 | 14 | 1.4 | 31.00 | 10.00 | 7.00 | 77.42% |

### TA-3.2.2. Flow-weighted Composite TSS Sampling

#### Sediment Basin #3 Clarksburg Town Center (Clarksburg SPA)

Sediment Basin #3 (Fig. TA-3.6) on Burdett Avenue is monitored quarterly for TSS using flow-weighted composite sampling.

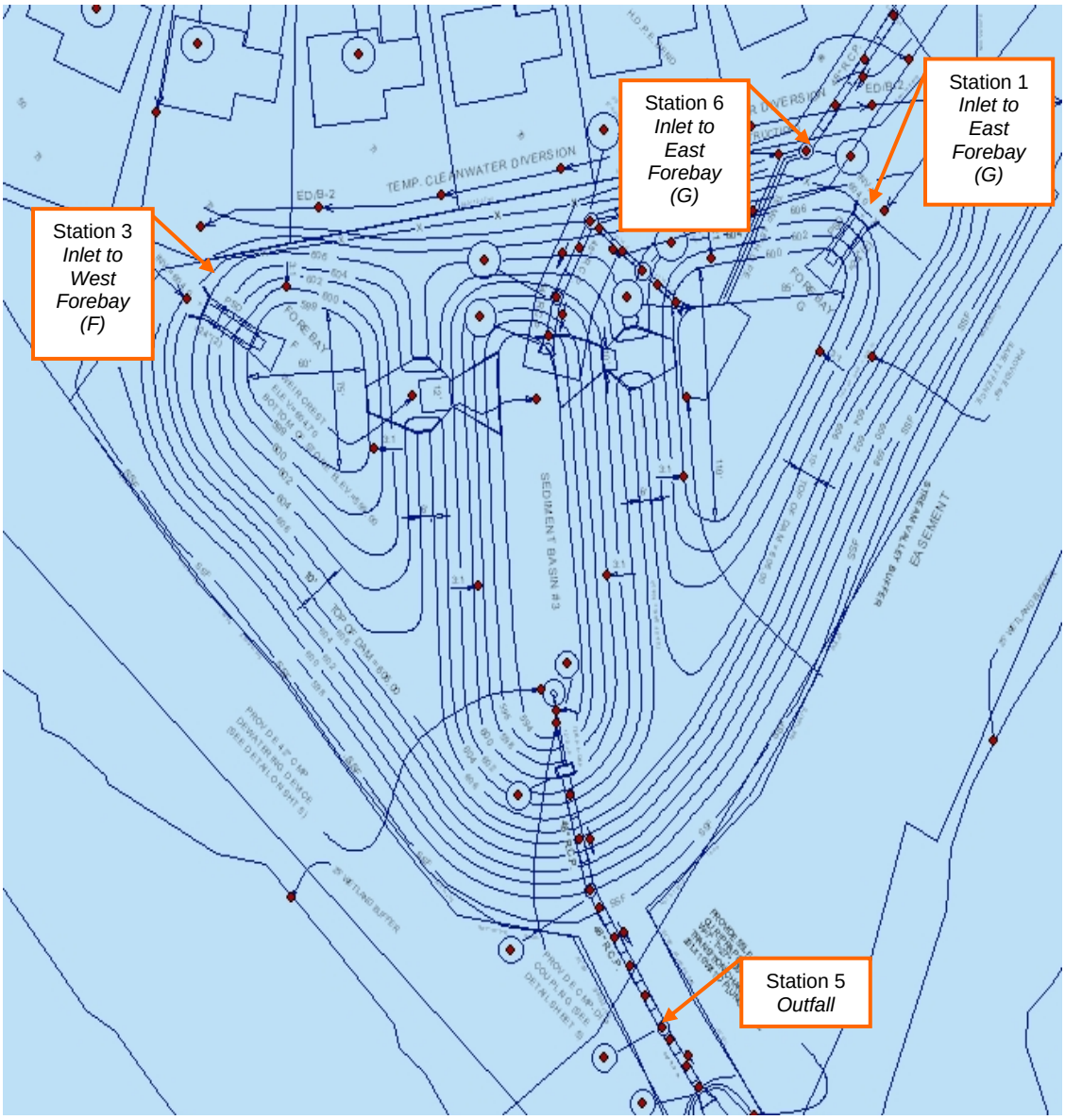


**Figure TA-3.6. Plan view of Clarksburg Town Center Sediment Basin #3.** Final monitoring stations (4) are indicated.

Complete TSS concentrations (Table TA-3.7) and loadings and reductions (Table TA-3.8) are provided.

**Table TA-3.7. TSS concentration results (mg/L) for flow-weighted composite sampling of Sediment Basin #3 at Clarksburg Town Center.**

| Storm Number | Date of Rainfall | Rainfall (inches) | Rainfall Duration (hours) | Rainfall Return Interval | TSS Concentration (mg/L) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Station 1 | Station 3 | Station 5 | Station 6 |
| | | | | | Inlet to East Forebay (Forebay G) | Inlet to West Forebay (Forebay F) | Outfall (initial round of sampling) | 48" Concrete Inlet to East Forebay (G) |
| 1 | 3/23/2005 | 2.11 | 14.75 | < 1 yr | 590 | 1300 | 420 | * |
| 2 | 3/27/2005 | 1.37 | 26.25 | < 1 yr | 1600 | 850 | 500 | * |
| 3 | 4/1/2005 | 1.93 | 26.00 | < 1 yr | 4,200 | 4,400 | 1,100 | * |
| 4 | 4/30/2005 | 0.82 | 22.25 | < 1 yr | 230 | 140 | 40 | 630 |
| 5 | 5/19/2005 | 1.04 | 14.15 | < 1 yr | 240 | N.S. | 94 | 670 |
| 6 | 5/23/2005 | 0.84 | 29.25 | < 1 yr | 160 | N.S. | 35 | 200 |
| 7 | 4/21/2006 | 1.11 | 40.67 | < 1 yr | 200 | N.S. | 28 | 40 |
| 8 | 5/11/2006 | 1.76 | 13.00 | < 1 yr | 1800 | 370 | 230 | 610 |
| 9 | 6/1/2006 | 0.45 | 9.00 | < 1 yr | 3000 | N.S. | 37 | 1400 |
| 10 | 9/1/2006 | 1.95 | 31.58 | < 1 yr | 12 | N.S. | 3 | 2 |
| 11 | 12/22/2006 | 1.30 | 15.67 | < 1 yr | 120 | 3700 | 68 | 74 |
| 12 | 3/15/2007 | 2.09 | 47.00 | < 1 yr | 17 | N.S. | 4 | 54 |

* - An additional inlet to the east forebay (Forebay G) was discovered after the third monitored storm (April 1, 2005)

(a) N.S. denotes no samples taken due to low water levels in pipe.

**Table TA-3.8. Clarksburg Town Center total suspended solids (TSS) loadings and reductions.** A negative percent reduction indicates that more of a pollutant is leaving the system than is entering. Loadings were not calculated for storm numbers 1, 2, 3, or 7 due to unaccounted for inputs and invalid flow rate.

| Storm Number | Date of Event | TSS Loading (lbs) | | | TSS Reduction | | Discharge Volume (CF) | | Duration of Outfall Sampling (hrs) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Inlets | Outfall (One Round) | Outfall (Extended Sampling) | One Round Outfall Sampling | Extended Outfall Sampling | Combined Inlets | Initial Round of Outfall Sampling | One Round | Extended * |
| 4 | 4/30/2005 | 520.7 | 29.4 | 89 | 94% | 83% | 65,488.40 | 57,292.90 | 55.33 | 339.6 |
| 5 | 5/19/2005 | 366 | 43.2 | 68.5 | 88% | 81% | 43,992.00 | 35,813.40 | 46 | 88.75 |
| 6 | 5/23/2005 | 146 | 17.5 | 34.3 | 88% | 77% | 57,025.00 | 38,853.00 | 44 | 170.5 |
| 8 | 5/11/2006 | 342.1 | 196.7 | n.a. | 43% | n.a. | 24,563.40 | 66,577.80 | 60 | n.a. |
| 9 | 6/1/2006 | 1179.8 | 37.1 | n.a. | 97% | n.a. | 64,989.20 | 78,096.60 | 76.67 | n.a. |
| 10 | 9/1/2006 | 3.1 | 4.4 | n.a. | -44%** | n.a. | 114,413.10 | 114,048.60 | 80 | n.a. |
| 11 | 12/22/2006 | 108.4 | 14.3 | n.a. | 87% | n.a. | 62,710.90 | 16,393.20 | 69 | n.a. |
| 12 | 3/15/2007 | 87.2 | 4.3 | n.a. | 95% | n.a. | 127,003.40 | 83,313.60 | 86.25 | n.a. |
| | Average | | | | 68% | 80% | | | | |

n.a. = not applicable; extended outfall sampling did not occur after 2005.

* - Extended sampling involved collection until the flow at the outfall became a "trickle" or another storm occurred (Jones 2007).

** - The negative sediment removal efficiency during the September 1, 2006 storm was most likely due to low TSS concentrations in the runoff and resuspension of sediment in the trap.

Monitoring requirements and the dates of monitoring are provided in Table TA-3.9.

**Table TA-3.9. Clarksburg Town Center Monitoring.**

| Monitoring Requirement | Dates of Construction Monitoring | | |
|---|---|---|---|
| | **Pre** | **During** | **Post** [(a)] |
| Annual baseflow and flow-weighted stormwater samples | April 1997 - May 1998 | 5/2/2001 - present | n/a |
| Continuous flow data and stream stage | | 10/5/2000 - present | n/a |
| Instream temperature | | 9/28/2000 - present | n/a |
| Embeddedness | | | n/a |
| Cross sections | | 4/2005 - present | n/a |
| Groundwater monitoring | | Phase II Monitoring (TBD) | n/a |
| S&EC Basin (TSS) | Not required | 1/2005 to present | Not required |
| SWM BMP Efficiency | Not required | Not required | n/a |
| | | | |

(a) - Clarksburg Town Center is still under construction and post-construction monitoring will not begin until S&EC structures are converted and as-builts are approved.

### Sediment Basin #2 Gateway Commons (Clarksburg SPA)

Sediment Basin #2 (Fig. TA-3.7) on Roberts Tavern Drive in Gateway Commons is monitored quarterly for TSS using flow-weighted composite sampling. Monitoring was conducted from April through October 2006. Construction began on February 12, 2005, but monitoring was delayed by the need to finalize the basin configuration and to direct overland flows to the basin. Construction activities ceased in March 2006 while an additional plan was reviewed.

Complete storm event information and TSS concentrations, loadings, and reductions (Table TA-3.10) are provided.

Monitoring requirements and the dates of monitoring are provided in Table TA-3.11.

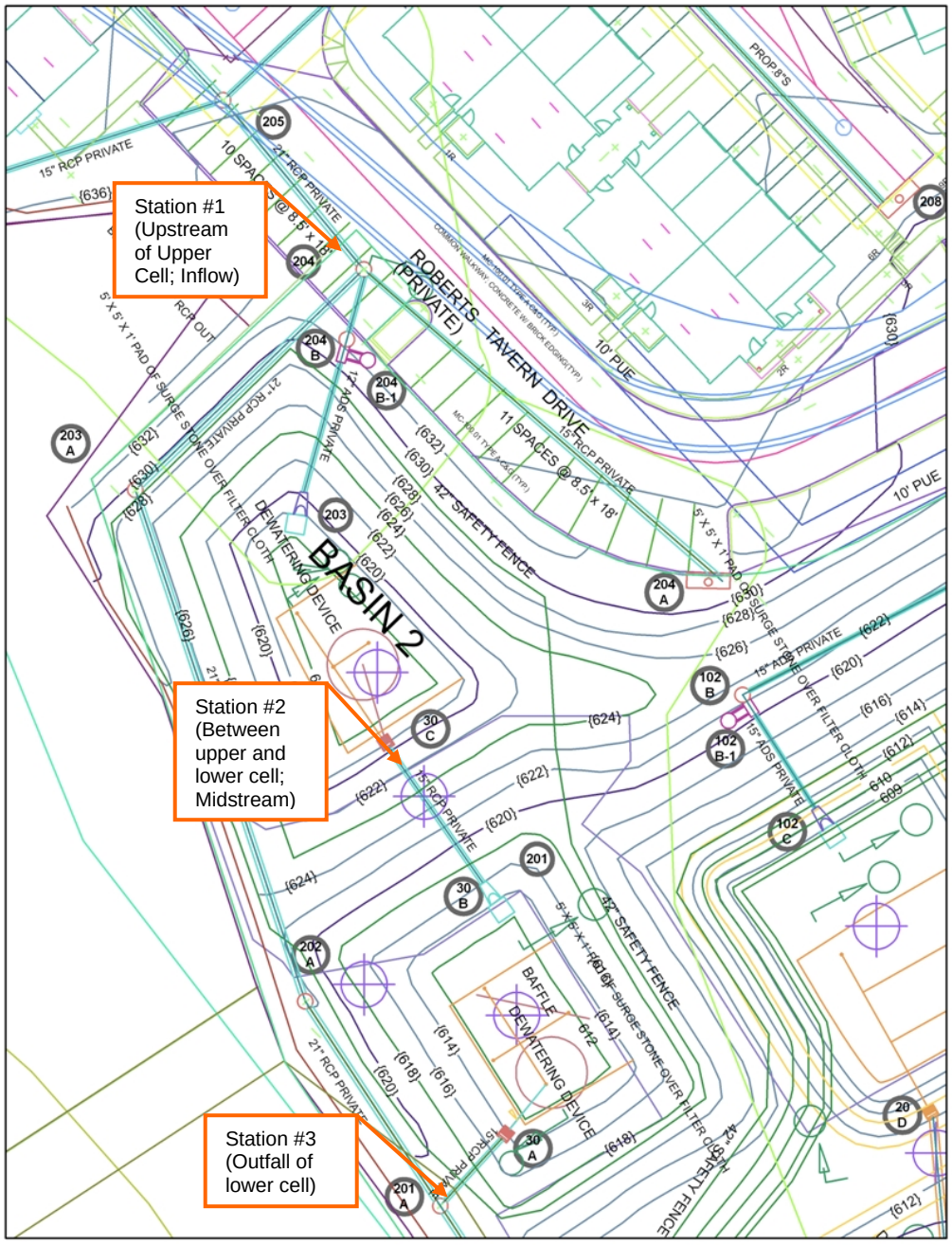


**Figure TA-3.7. Plan view and sampling locations of Gateway Commons Sediment Basin #2.**

**Table TA-3.10. Total suspended solids (TSS) monitoring at Gateway Commons Sediment Basin #2.**

| Date of Event | Rainfall | | | TSS Concentration (mg/L) | | | TSS Loading (lbs) | | | TSS Load Reduction | Discharge Vol. (CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Amount (inches) | Duration (hours) | Return Interval (year) | Station #1 [(a)] | Station #2 | Station #3 | Station #1 | Station #2 | Station #3 | #1 to #2 | Station #1 | Station #2 |
| 4/21/2006 | 1.11 | 40.67 | < 1 | 11 | 57 | n.a. | 18 | 3.4 | n.a. | 81% | 127,646.40 | 4,598.40 |
| 5/11/2006 | 1.76 | 13 | < 1 | 22 | 19 | n.a. | 10.6 | 0.8 | n.a. | 92% | 37,628.40 | 3,286.50 |
| 9/1/2006 | 1.95 | 31.58 | < 1 | 1 | n.a.[(b)] | n.a. | 0.3 | n.a. | n.a. | 100% | 21,450.60 | n.a. |
| 9/28/2006 | 0.79 | 5.5 | < 1 | 31 | n.a. | n.a. | 2.4 | n.a. | n.a. | 100% | 6,084.60 | n.a. |

(a) Station locations are provided in Figure TA-3.7.
(b) n.a. not applicatble (no samples taken due to low water levels in pipe)

**Table TA-3.11. Monitoring requirements and dates for the Gateway Commons Property.**

| Monitoring Requirement | Monitoring dates [(a)] |
|---|---|
| Groundwater elevations; year-round | 1/30/2003 - present |
| Cross sections | |
| Instream temperature | 6/1/2003 - present |
| Continuous flow | 2/5/2003 - present |
| S&EC Basin (TSS); quarterly | 10/27/2005 - present; during construction only |
| SWM BMP Efficiency | n/a; post-construction only |

(a) - Gateway Commons is still under construction and post-construction monitoring will not begin until S&EC structures are converted and as-builts are approved.

## Other Projects

### Stringtown Rd. Extension

The site plan and sampling locations for Stringtown Rd. Extension Sediment Basin #3 are provided (Fig. TA-3.8). Storm event TSS concentrations are provided in Table TA-3.12. No storm characteristic data have been submitted by the consultant. No monitoring other than TSS during construction and pollutant removal post construction efficiency is required at this property.

**Table TA-3.12. Total suspended solids (TSS concentrations) of captured storm events for Stringtown Rd. Extension Sediment Basin #3.**

| Date of Event | TSS (mg/L) | | Discharge (CF) | | Volume (L) | |
|---|---|---|---|---|---|---|
| | Station #1 | Station #2 | Station #1 | Station #2 | Station #1 | Station #2 |
| 9/1/2006 | 15 | n/a * | 7851.6 | n/a * | 222332.5321 | n/a * |
| 9/28/2006 | 380 | n/a * | 1612.2 | n/a * | 45652.41584 | n/a * |
| 3/15/2007 | 23 | 15 | 1105590 ** | 10872 | 31306819.52 | 307860.7276 |
| 4/11/2007 | 28 | 14 | 2917.1 | 655 | 82603.06552 | 18547.5328 |
| 6/28/2007 | 1700 | 9 | 3457 | 269 | 97891.32958 | 7617.231026 |
| 12/2/2007 | 16 | 2 | 1843 | 811 | 52187.94342 | 22964.96045 |

* - Downstream station not sampled due to low water levels in the pipe

** - Upstream discharge for 3/15/2007 event inaccurate due to backwater in pipe.

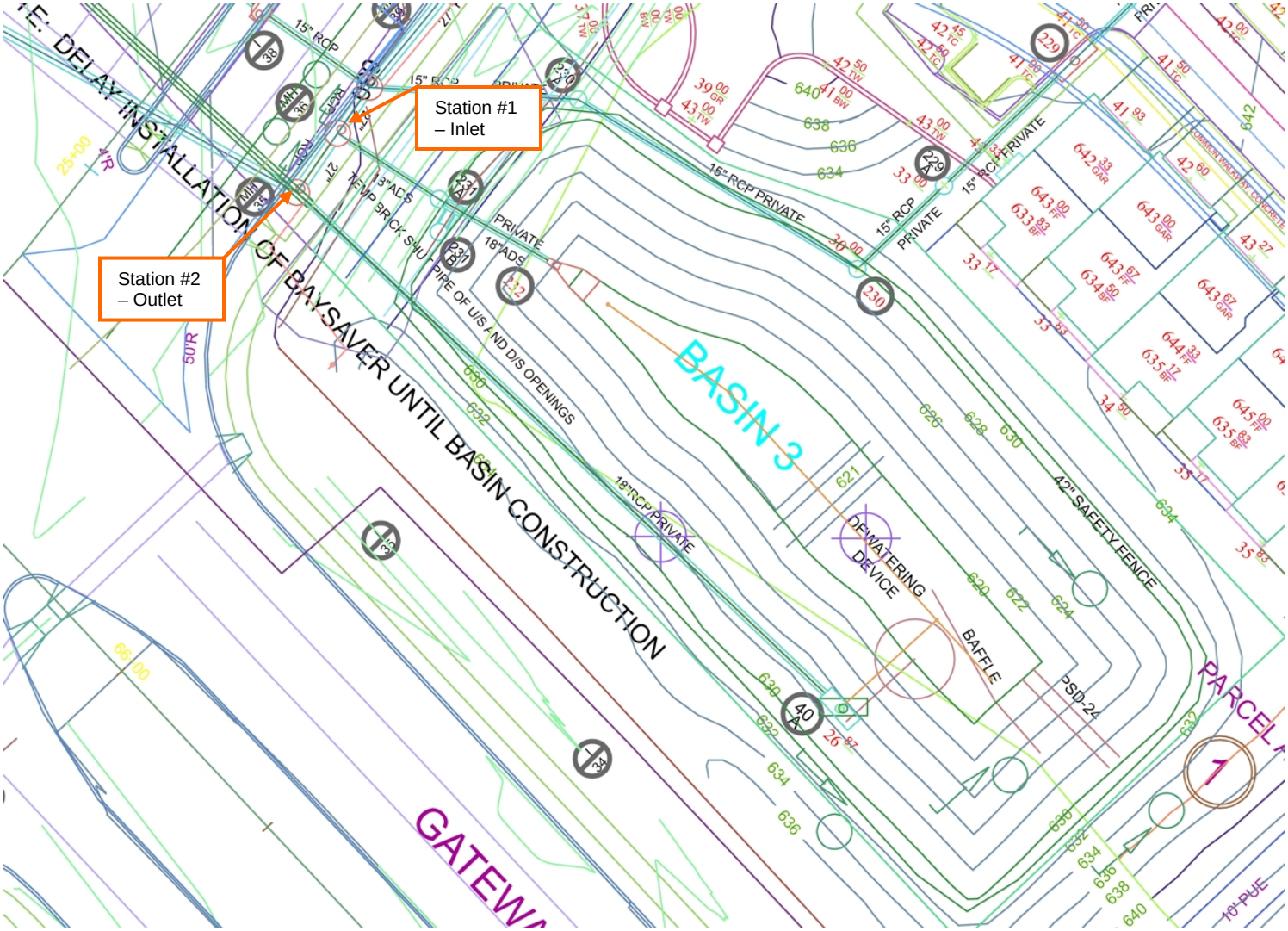


**Figure TA-3.8. Plan view and sampling locations of Stringtown Rd. Extension Sediment Basin #3.**

## TA-3.3. Stormwater Management (SWM) BMP Monitoring

### Stormwater treatment trains in SPAs

Various BMPs are combined in series or as part of a treatment train in order to maximize pollutant reduction and improve stormwater treatment performance. Redundant controls (treatment trains) are required for stormwater quality control in SPAs (Fig. TA-3.9).

### TA-3.3.1 Surface Sand Filter

#### Background

For more information on surface sand filters, please consult the following suggested materials:

http://permittingservices.montgomerycountymd.gov/permitting/docs/rev2005MCSF.pdf - Montgomery County Sand Filter (MCDPS 2007)

http://www.epa.gov/owm/mtb/sandfltr.pdf – Fact Sheet Sand Filters (US EPA 1999a)

http://www.epa.gov/nrmrl/pubs/600r04184/600r04184.pdf - The Use of Best Management Practices (BMPs) in Urban Watersheds (US EPA 2004).

http://www.cwp.org/Resource_Library/Center_Docs/PWP/ELC_PWP105.pdf – Developments in Sand Filter Technology to Treat Stormwater Runoff. (T.R.S. 2002)

http://www.fhwa.dot.gov/environment/ultraurb/3fs8.htm –Fact Sheet – Surface Sand Filters (Shoemaker et al. 2002a)

http://www.metrocouncil.org/environment/Watershed/BMP/CH3_STFiltSurfSand.pdf – Chapter 3: Best Management Practices: Surface Sand Filters (Metropolitan Council & Barr Engineering Co. 2001)

Full citations are provided in the Literature Cited section at the end of this document.

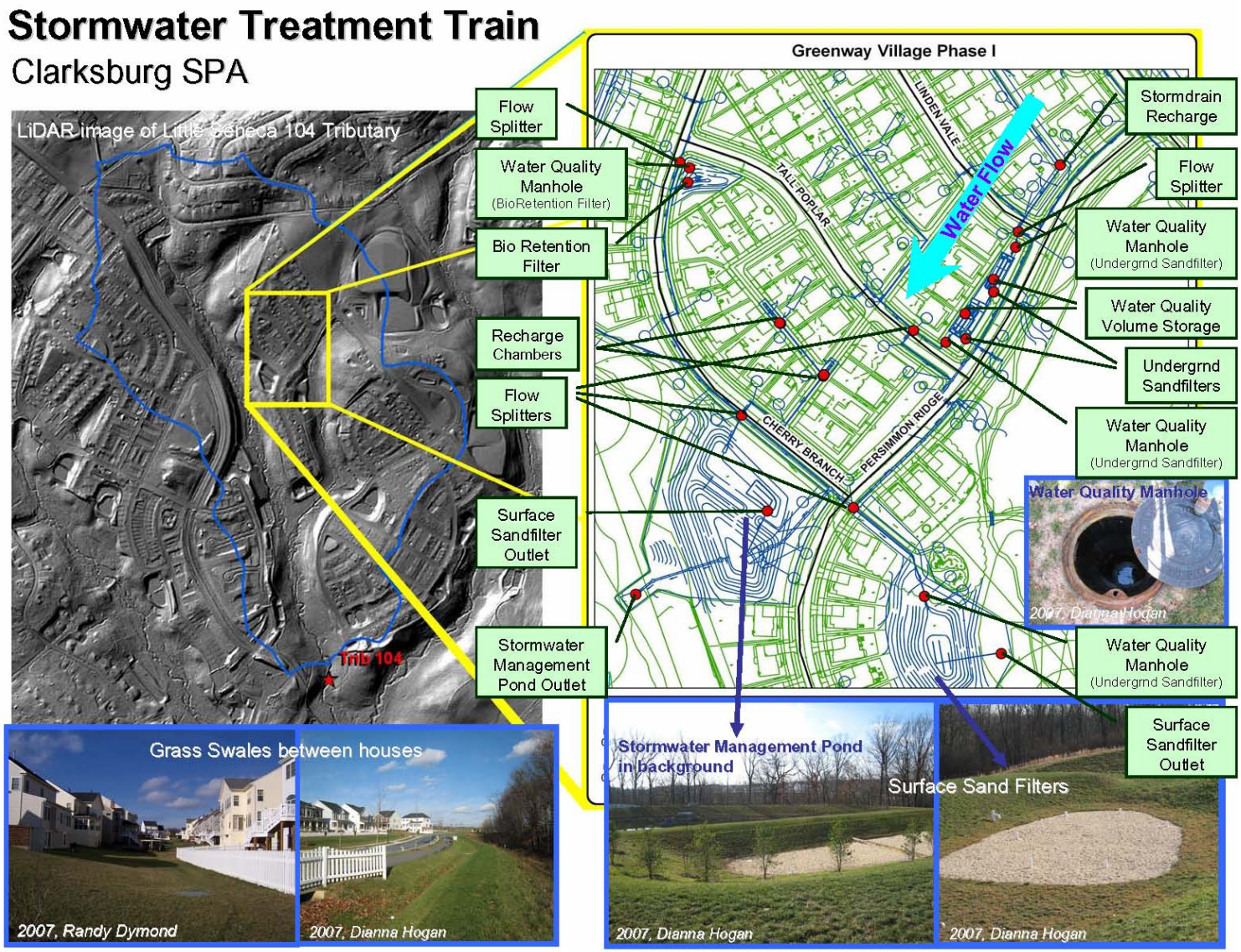


**Figure TA-3.9. Enlargement of a section of the 2007 LiDAR image of Greenway Village Development (Newcut Road Neighborhood) showing the redundant water quality and quantity SWM BMPs designed to mitigate imperviousness impacts.**

### Willow Oaks (Piney Branch SPA)

An aerial and plan view of the Willow Oaks sand filters (two in series) are provided (Figs TA-3.10 and TA-3.11). BMP pollutant removal efficiency data was collected using flow-weighted composite sampling. Table TA-3.13 lists the parameters and detection limits for the Willow Oaks SWM BMP monitoring.

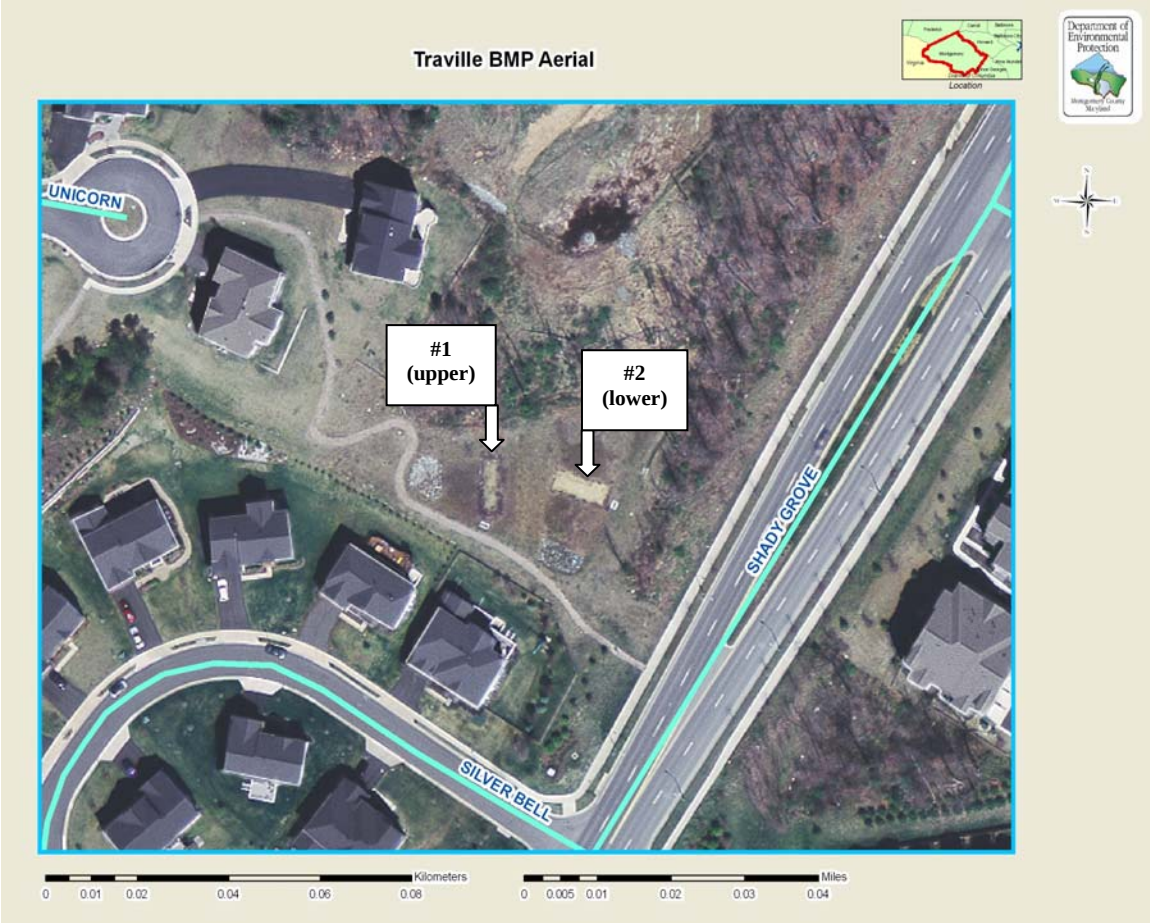


**Figure TA-3.10. Willow Oaks Sand Filters.**

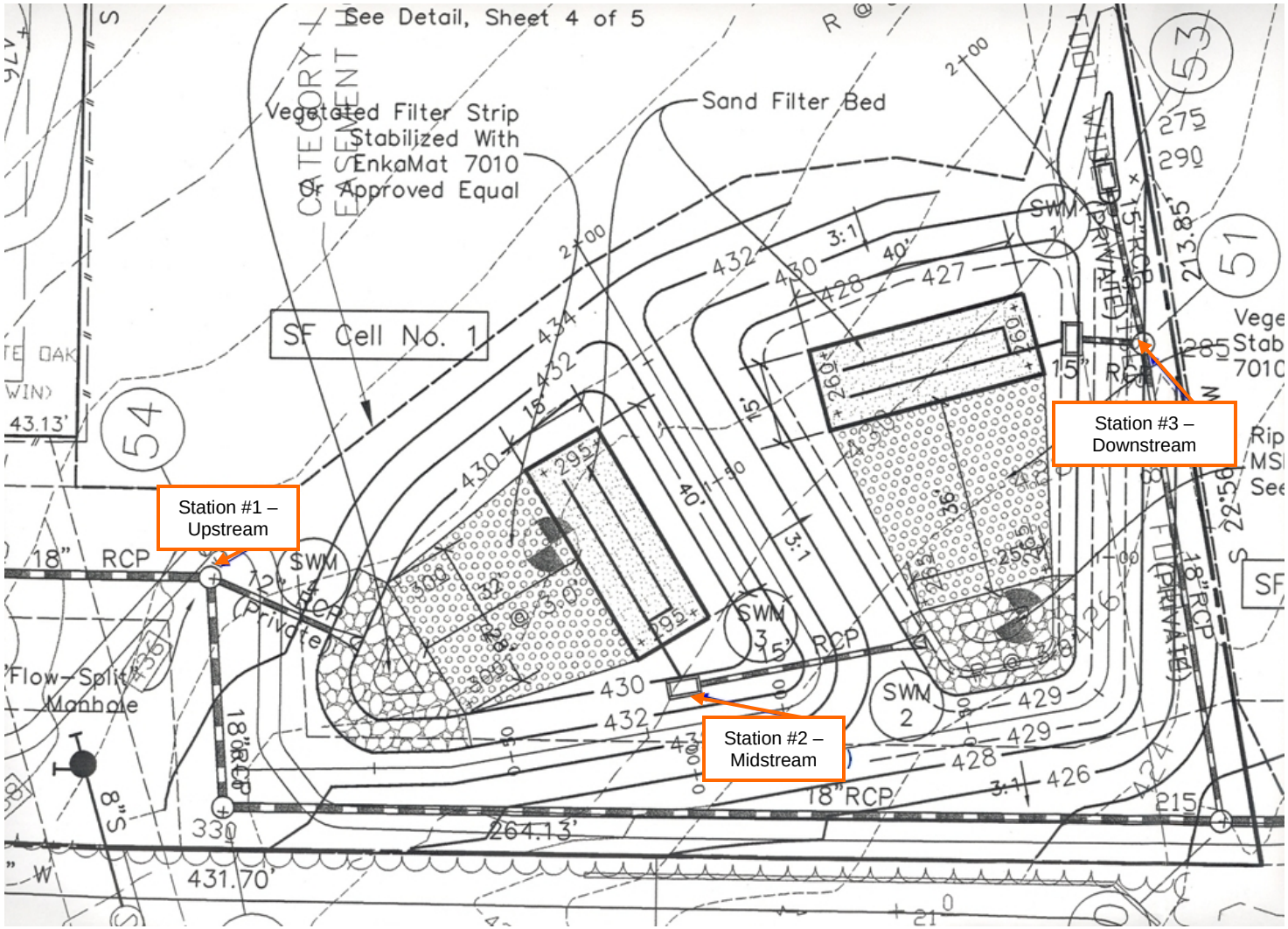


**Figure TA-3.11. Plan view of Willow Oaks BMP with monitoring locations (3) denoted.**

**Table TA-3.13. Parameters and detection limits for Willow Oaks BMP monitoring.**

| Parameter | Detection Limit (mg/L) | Method | MD Freshwater Acute Criteria (mg/L)* |
|---|---|---|---|
| Cadmium | 0.0005 | EPA 200.8 | 0.002 |
| Copper | 0.002 | EPA 200.8 | 0.013 |
| Lead | 0.002 | EPA 200.8 | 0.065 |
| Zinc | 0.010 | EPA 200.8 | 0.12 |
| Nitrate | 0.02 | EPA 353.1 | None |
| Nitrite | 0.02 | EPA 353.1 | None |
| Total Kjeldahl Nitrogen (TKN) | 0.5 | EPA 351.3 | None |
| Total Nitrogen | 0.02 | EPA 353.1/351.3 | None |
| Total Suspended Solids (TSS) | 1.0 | EPA 160.2 | None |
| Total Phosphorus | 0.01 | EPA 365.2 | None |
| Orthophosphate | 0.01 | EPA 365.2 | None |

* Water quality criteria for metals are based on dissolved forms; water chemistry data provided are for total metal concentration.

Concentrations and loadings of pollutants from monitored storm events are presented (Tables TA-3.14 – TA-3.17).

**Table TA-3.14. Characteristics of monitored storms at the Willow Oaks sand filters.** Loadings were calculated for the shaded events.

| | Storm Characteristics | | | | Discharge Volume ($m^3$) | | |
|---|---|---|---|---|---|---|---|
| Date of Event | Rain (in .) | Rainfall Duration (hours) | Rainfall Return Interval | Preceding drying time (h) | Station #1 | Station #2 | Station #3 |
| **7/7/2005** | 2.59 | 14.5 | < 2 | 42.25 | 5,712 | 6,440[a] | 24,577[b] |
| **10/24/2005** | 1.35 | 29.25 | < 1 | 46.5 | 4,660 | 981 | 15,396[b] |
| **1/22/2006** | 0.8 | 14.5 | < 1 | 108.25 | 2,737 | 410 | 293 |
| **4/21/2006** | 1.51 | 26.75 | < 1 | 104.5 | 2,649 | 2,984[a] | 269 |
| **9/28/2006** | 0.73 | 4.75 | < 1 | 98.5 | 636 | 34 | 1,497[b] |
| **10/17/2006** | 0.74 | 9 | < 1 | 116.5 | 1,161 | 73 | 37 |
| **11/16/2006** | 1.60[c] | 7.75 | < 1 | 72 | 3,887 | 8,337[a] | 99 |
| **4/11/2007** | 0.72 | 7.25 | < 1 | 105 | 723 | 57 | 85 |

[a] Inaccurate flow rate measurement due to ponding in weir (Station #2)

[b] Inaccurate flow rate measurement due to bubble line misplacement or pinching (Station #3)

**Table TA-3.15. Willow Oaks storm concentrations and loadings of metals.** Loadings are not calculated if flow value is inaccurate and not presented if concentration was below the detection limit. A negative percent reduction indicates that more of pollutant is leaving the system than is entering.

| Storm Date | Cadmium | | | | Copper | | | | Lead | | | | Zinc | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pol. Red. (In vs. Out) | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pol. Red. (In vs. Out) | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pol. Red. (In vs. Out) | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pol. Red. (In vs. Out) |
| **Analytical Concentration (mg/L) and Pollutant Reduction (%)** | | | | | | | | | | | | | | | | |
| 7/7/2005 | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.005 | 0.006 | 0.008 | -60.0% | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.022 | 0.021 | 0.023 | -4.5% |
| 10/24/2005 | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.009 | 0.010 | 0.006 | 33.3% | B.D.L. | B.D.L. | B.D.L. | n.c. | B.D.L. | 0.01 | 0.012 | n.c. |
| 1/22/2006 | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.011 | 0.008 | 0.011 | 0.0% | 0.0032 | B.D.L. | B.D.L. | n.c. | 0.0619 | 0.0221 | 0.0277 | 55.3% |
| 4/21/2006 | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.017 (†) | 0.012 | 0.010 | 41.2% | 0.004 | B.D.L. | B.D.L. | n.c. | 0.041 | 0.016 | 0.012 | 70.7% |
| 9/28/2006 | B.D.L. | 0.0007 | B.D.L. | n.c. | 0.021(†) | 0.110 (†) | 0.015 (†) | 28.6% | 0.003 | 0.015 | B.D.L. | n.c. | 0.068 | 0.14 (†) | 0.028 | 58.8% |
| 10/17/2006 | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.008 | 0.008 | 0.009 | -12.5% | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.042 | 0.028 | 0.027 | 35.7% |
| 11/16/2006 | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.007 | 0.009 | B.D.L. | n.c. | 0.003 | B.D.L. | B.D.L. | n.c. | 0.054 | 0.048 | B.D.L. | n.c. |
| 4/11/2007 | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.0083 | 0.0093 | 0.0078 | 6.0% | 0.0023 | B.D.L. | B.D.L. | n.c. | 0.062 | 0.0446 | 0.0616 | 0.6% |
| **Pollutant Loadings (g) and Pollutant Reduction (%)** | | | | | | | | | | | | | | | | |
| 7/7/2005 | n.c. | * | * | n.c. | 28.6 | * | * | n.c. | n.c. | * | * | n.c. | 125.7 | * | * | n.c. |
| 10/24/2005 | n.c. | n.c. | * | n.c. | 41.9 | 9.8 | * | n.c. | n.c. | n.c. | * | n.c. | n.c. | 9.8 | * | n.c. |
| 1/22/2006 | n.c. | n.c. | n.c. | n.c. | 30.1 | 3.3 | 3.2 | 89.3% | 8.8 | n.c. | n.c. | n.c. | 169.4 | 9.1 | 8.1 | 95.2% |
| 4/21/2006 | n.c. | * | n.c. | n.c. | 45.0 | * | 2.7 | 94.0% | 10.6 | * | n.c. | n.c. | 108.6 | * | 3.2 | 97.0% |
| 9/28/2006 | n.c. | 0.02 | * | n.c. | 13.4 | 3.8 | * | n.c. | 1.9 | 0.5 | * | n.c. | 43.3 | 4.8 | * | n.c. |
| 10/17/2006 | n.c. | n.c. | n.c. | n.c. | 9.3 | 0.6 | 0.3 | 96.4% | n.c. | n.c. | n.c. | n.c. | 48.8 | 2.0 | 1.0 | 97.9% |
| 11/16/2006 | n.c. | * | n.c. | n.c. | 27.2 | * | n.c. | n.c. | 11.7 | * | n.c. | n.c. | 209.9 | * | n.c. | n.c. |
| 4/11/2007 | n.c. | n.c. | n.c. | n.c. | 6.0 | 0.5 | 0.7 | 89.0% | 1.7 | n.c. | n.c. | n.c. | 44.9 | 2.5 | 5.2 | 88.4% |

* - Loading not calculated due to inaccurate flow rate measurement

(†) At or above acute criteria value (Refer to Table TA-3.13)

B.D.L - Concentration (mg/L) below detection limit (Refer to Table TA-3.13)

n.c. - Not Calculated (if concentration was below detectable limit or flow value was inaccurate)

**Table TA-3.16. Willow Oaks storm concentrations and loadings of nitrogen-based nutrients (nitrate, nitrite, total kjeldahl nitrogen (TKN), total nitrogen).** Loadings are not calculated if flow value is inaccurate and not presented if concentration was below the detection limit. A negative percent reduction indicates that more of pollutant is leaving the system.

| Storm Date | Nitrate | | | | Nitrite | | | | TKN | | | | Total Nitrogen | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pol. Red. (In vs. Out) | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pol. Red. (In vs. Out) | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pol. Red. (In vs. Out) | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pol. Red. (In vs. Out) |
| **Analytical Concentration (mg/L) and Pollutant Reduction (%)** | | | | | | | | | | | | | | | | |
| 7/7/2005 | 0.1 | 0.06 | 0.08 | 20.0% | 0.02 | 0.02 | B.D.L. | n.c. | 1 | 1.2 | B.D.L. | n.c. | 1.1 | 1.3 | 0.08 | 92.7% |
| 10/24/2005 | 0.18 | 0.25 | 0.35 | -94.4% | B.D.L. | 0.02 | 0.02 | n.c. | 1 | 0.7 | 0.6 | 40.0% | 1.2 | 0.95 | 0.97 | 19.2% |
| 1/22/2006 | 0.24 | 0.2 | 0.14 | 41.7% | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.6 | 0.6 | 0.6 | 0.0% | 0.84 | 0.8 | 0.74 | 11.9% |
| 4/21/2006 | 0.46 | 0.47 | 0.63 | -37.0% | B.D.L. | 0.04 | 0.04 | n.c. | 1.6 | 1.0 | 0.7 | 56.3% | 2.1 | 1.5 | 1.4 | 33.3% |
| 9/28/2006 | 0.59 | 0.46 | 0.42 | 28.8% | 0.02 | 0.03 | 0.02 | 0.0% | B.D.L. | B.D.L. | 0.8 | n.c. | 0.61 | 0.49 | 0.52 | 14.8% |
| 10/17/2006 | 0.35 | 0.30 | 0.23 | 34.3% | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.7 | B.D.L. | B.D.L. | n.c. | 0.42 | 0.30 | 0.23 | 45.2% |
| 11/16/2006 | 0.25 | 0.15 | 0.23 | 8.0% | 0.02 | B.D.L. | B.D.L. | n.c. | B.D.L. | B.D.L. | B.D.L. | n.c. | 0.27 | 0.15 | 0.23 | 14.8% |
| 4/11/2007 | 1.5 | 2.18 | 2.8 | -86.7% | 0.02 | 0.02 | B.D.L. | n.c. | 0.9 | B.D.L. | B.D.L. | n.c. | 2.4 | 2.2 | 2.8 | -16.7% |
| **Pollutant Loadings (g) and Pollutant Reduction (%)** | | | | | | | | | | | | | | | | |
| 7/7/2005 | 571.2 | * | * | n.c. | 114.2 | * | * | n.c. | 5712.2 | * | * | n.c. | 6283.5 | * | * | n.c. |
| 10/24/2005 | 838.8 | 245.3 | * | n.c. | n.c. | 19.6 | * | n.c. | 4660.1 | 686.9 | * | n.c. | 5592.1 | 932.2 | * | n.c. |
| 1/22/2006 | 656.9 | 82.0 | 41.0 | 93.80% | n.c. | n.c. | n.c. | n.c. | 1642.2 | 245.9 | 175.5 | 89.3% | 2299.1 | 327.9 | 216.5 | 90.6% |
| 4/21/2006 | 1218.6 | * | 169.3 | 86.10% | n.c. | * | 10.8 | n.c. | 4238.5 | * | 188.2 | 95.6% | 5563.0 | * | 376.3 | 93.2% |
| 9/28/2006 | 375.3 | 15.8 | * | n.c. | 12.7 | 1.0 | * | n.c. | n.c. | n.c. | * | n.c. | 388.0 | 16.9 | * | n.c. |
| 10/17/2006 | 406.4 | 21.8 | 8.6 | 97.90% | n.c. | n.c. | n.c. | n.c. | 812.8 | n.c. | n.c. | n.c. | 487.7 | 21.8 | 8.6 | 98.2% |
| 11/16/2006 | 971.9 | * | 22.8 | 97.70% | 77.7 | * | n.c. | n.c. | n.c. | * | n.c. | n.c. | 1049.6 | * | 22.8 | 97.8% |
| 4/11/2007 | 1085.2 | 124.6 | 237.1 | 78.10% | 14.5 | 1.1 | n.c. | n.c. | 651.1 | n.c. | n.c. | n.c. | 1736.2 | 125.8 | 237.1 | 86.3% |

* - Loading not calculated due to inaccurate flow rate measurement

B.D.L - Concentration (mg/L) below detection limit (Refer to Table TA-3.13)

n.c. = Not Calculated (if concentration was below detectable limit or flow value was inaccurate)

**Table TA-3.17. Willow Oaks storm concentrations and loadings of phosphorus-based nutrients (total phosphorus and orthophosphate) and total suspended solids (TSS).** Loadings are not calculated if flow value is inaccurate and not presented if concentration was below the detection limit. A negative percent reduction indicates that more of pollutant is leaving the system than is entering.

| Storm Date | Total Phosphorus | | | | Orthophosphate | | | | TSS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pollutant Reduction (In vs. Out) | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pollutant Reduction (In vs. Out) | Station 1 (In) | Station 2 (Mid) | Station 3 (Out) | Pollutant Reduction (In vs. Out) |
| **Analytical Concentration (mg/L) and Pollutant Reduction (%)** | | | | | | | | | | | | |
| 7/7/2005 | 0.07 | 0.07 | 0.06 | 14.3% | 0.04 | 0.04 | 0.03 | 25.0% | 20 | 5 | 16 | 20.0% |
| 10/24/2005 | 0.06 | 0.15 | 0.17 | -183.3% | 0.02 | 0.09 | 0.12 | -500.0% | 5 | 8 | 6 | -20.0% |
| 1/22/2006 | 0.11 | 0.11 | 0.1 | 9.1% | 0.03 | 0.03 | B.D.L. | n.c. | 18 | 10 | 24 | -33.3% |
| 4/21/2006 | 0.15 | 0.11 | 0.10 | 33.3% | 0.10 | 0.06 | 0.04 | 60.0% | 26 | 8 | 30 | -15.4% |
| 9/28/2006 | 0.25 | 0.12 | 0.11 | 56.0% | 0.13 | 0.05 | 0.02 | 84.6% | 3 | 16 | 12 | -300.0% |
| 10/17/2006 | 0.24 | 0.11 | 0.04 | 83.3% | 0.18 | 0.05 | 0.02 | 88.9% | 13 | 4 | 5 | 61.5% |
| 11/16/2006 | 0.22 | 0.13 | 0.18 | 18.2% | 0.13 | 0.09 | 0.10 | 23.1% | 18 | 11 | 20 | -11.1% |
| 4/11/2007 | 0.33 | 0.12 | 0.11 | 66.7% | 0.09 | 0.07 | 0.04 | 55.6% | 120 | 5 | 7 | 94.2% |
| **Pollutant Loadings (g) and Pollutant Reduction (%)** | | | | | | | | | | | | |
| 7/7/2005 | 399.9 | * | * | n.c. | 228.5 | * | * | n.c. | 114244.7 | * | * | n.c. |
| 10/24/2005 | 279.6 | 147.2 | * | n.c. | 93.2 | 88.3 | * | n.c. | 23300.6 | 7849.9 | * | n.c. |
| 1/22/2006 | 301.1 | 45.1 | 29.3 | 90.3% | 82.1 | 12.3 | n.c. | n.c. | 49265.8 | 4098.9 | 7021.0 | 85.7% |
| 4/21/2006 | 397.4 | * | 26.9 | 93.2% | 264.9 | * | 10.8 | 95.9% | 68875.5 | * | 8064.0 | 88.3% |
| 9/28/2006 | 159.0 | 4.1 | * | n.c. | 82.7 | 1.7 | * | n.c. | 1908.3 | 550.8 | * | n.c. |
| 10/17/2006 | 278.7 | 8.0 | 1.5 | 99.5% | 209.0 | 3.6 | 0.7 | 99.6% | 15094.1 | 290.1 | 186.3 | 98.8% |
| 11/16/2006 | 855.2 | * | 17.8 | 97.9% | 505.4 | * | 9.9 | 98.0% | 69974.1 | * | 1980.7 | 97.2% |
| 4/11/2007 | 238.7 | 6.9 | 9.3 | 96.1% | 65.1 | 4.0 | 3.4 | 94.8% | 86812.2 | 285.8 | 592.8 | 99.3% |

* - Loading not calculated due to inaccurate flow rate measurement

B.D.L - Concentration (mg/L) below detection limit (Refer to Table TA-3.13)

n.c. = Not Calculated (if concentration was below detectable limit or flow value was inaccurate)

### Snider's Estates (Upper Paint Branch SPA)

Total suspended solids were monitored using grab sampling at Snider's Estates during construction. Only flow leaving the pond (Pond 1) was monitored during post-construction. The plan view of the Snider's Estates pond and monitoring locations are provided (Fig. TA-3.12). A total of fifteen storms were captured (Table TA-3.18). Only storms with a return interval >1 year were compared with the TR-20 model expected values.

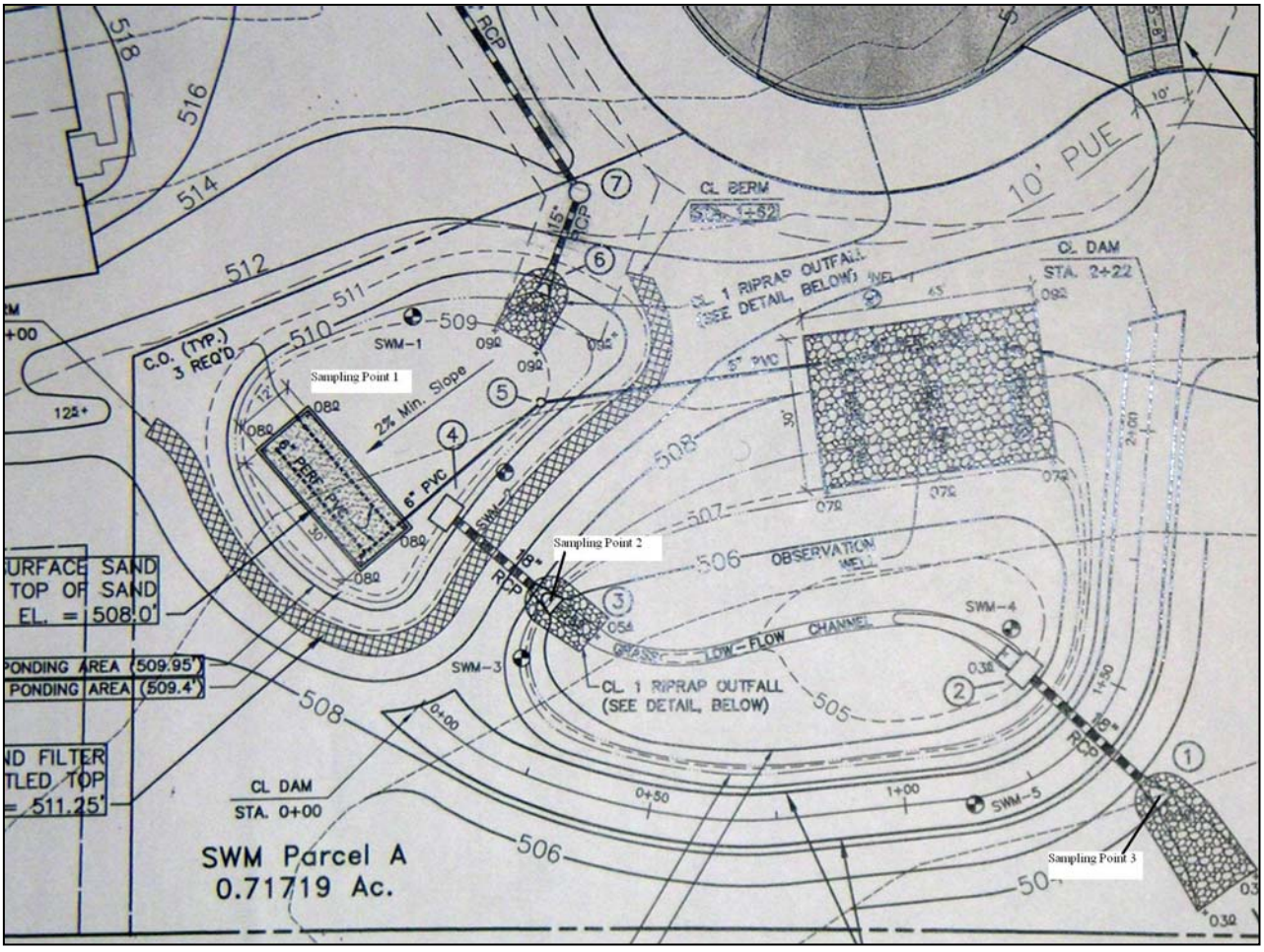


**Figure TA-3.12. Plan view of Snider's Estates SWM with marked sampling locations.** The plan illustrates during construction sampling points (3) and the discussed post-construction flow monitoring station (Sampling Point 2).

**Table TA-3.18. Storm events measured for flow exiting Snider's Estates SWM Pond 1.** Events with flow values used to compare with the simulated values are highlighted.

| Date | Quantity of Rain (In.) | Dry Time (Hr.) | Rainfall Duration (Hr.) | Elevated Flow Duration (Hr.) | Average Rainfall Rate (In./Hr.) | Return Interval (Yr.) | Maximum Flow Rate (CFS) |
|---|---|---|---|---|---|---|---|
| 12/23/2004 | 0.87 | 1 | 3.33 | 2.33 | 0.26 | < 1 | 1.386 |
| 1/14/2005 | 1.99 | 1.83 | 6.83 | 6.67 | 0.29 | 1-2 | 4.554 |
| 3/23/2005 | 1.82 | 69.33 | 16.83 | 2 | 0.11 | < 1 | 0.459 |
| 3/27/2005 | 1.00 | 1.17 | 8.5 | 6.83 | 0.12 | < 1 | 1.678 |
| 4/1/2005 | 1.55 | 1.5 | 13.67 | 14.33 | 0.11 | < 1 | 1.96 |
| 6/29/2005 | 1.35 | 10.17 | 3.83 | 1.17 | 0.35 | < 1 | 0.133 |
| 7/7/2005 | 2.93 | 1 | 15.17 | 9.5 | 0.19 | 2 | 4.98 |
| 7/14/2005 | 1.49 | 6.5 | 8.83 | 10 | 0.17 | < 1 | 2.621 |
| 7/16/2005 | 0.51 | 1.67 | 5.5 | 8.17 | 0.09 | < 1 | 2.269 |
| 7/29/2005 | 1.17 | 41.67 | 4.17 | 0.67 | 0.28 | < 1 | 0.271 |
| 10/7/2005 | 6.13 | 1 | 25.5 | 26.17 | 0.24 | 25 | 3.541 |
| 12/15/2005 | 1.25 | 122.5 | 10.25 | 3.17 | 0.12 | < 1 | 0.298 |
| 6/25/2006 | 6.84 | 1.33 | 9.17 | 8.83 | 0.75 | 200 | 10.671 |
| 6/13/2007 | 1.95 | 3.33 | 2.17 | 0.33 | 0.9 | 5 | 0.042 |
| 10/24/2007 | 4.38 | 101.67 | 77.33 | 22.33 | 0.06 | 2 | 0.011 |

### TA-3.3.2 Stormceptor® Results

#### Background

Suggested materials for information on Stormceptor® function and effectiveness:

http://www.epa.gov/region1//assistance/ceitts/stormwater/techs/stormceptor.html – Storm Water Virtual Trade Show Stormceptor® (Rinker Materials 2007)

http://www.ceere.org/ees/EES_Publications/step/Stormceptor%20fact%20sheet%20revised%20203.pdf – Stormwater Technology: Stormceptor (STEP 2003)

http://www.stormwatercenter.net/Practice/120-Stormceptor.pdf – Performance of a Proprietary Stormwater Treatment Device: The Stormceptor® (RAC 2002)

http://www.stormceptor.com/ – Stormceptor ® home page (Imbrium Systems Inc. 2007)

http://www.fhwa.dot.gov/environment/ultraurb/3fs14.htm – Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring Fact Sheet - Manufactured Systems (Shoemaker et al. 2002b)

http://www.epa.gov/OW-OWM.html/mtb/hydro.pdf - EPA Storm Water Technology Fact Sheet: Hydrodynamic Separators (US EPA 1999b).

Full citations are provided in the Literature Cited section at the end of this document.

**Cloverly Safeway (Upper Paint Branch SPA)**

The Stormceptor® functions as additional quality control in the stormwater treatment train utilized at the Cloverly Safeway at Paint Branch SPA. A diagram of Cloverly Safeway stormwater BMPs and sampling locations is provided (Figure TA-3.13). Post construction monitoring of stormwater chemistry as it passes through the device was conducted using automated sampling from May 2003 through October 2007. First flush grab samples of total petroleum hydrocarbons (TPH) of influent and effluent as well as continuous monitoring of effluent temperature was also conducted.

Parameters and detection limits are provided in Table TA-3.19. Eleven of the fifteen required storms have been captured; storm characteristics are provided in Table TA-3.20 and loading and concentration data in Table TA-3.21.

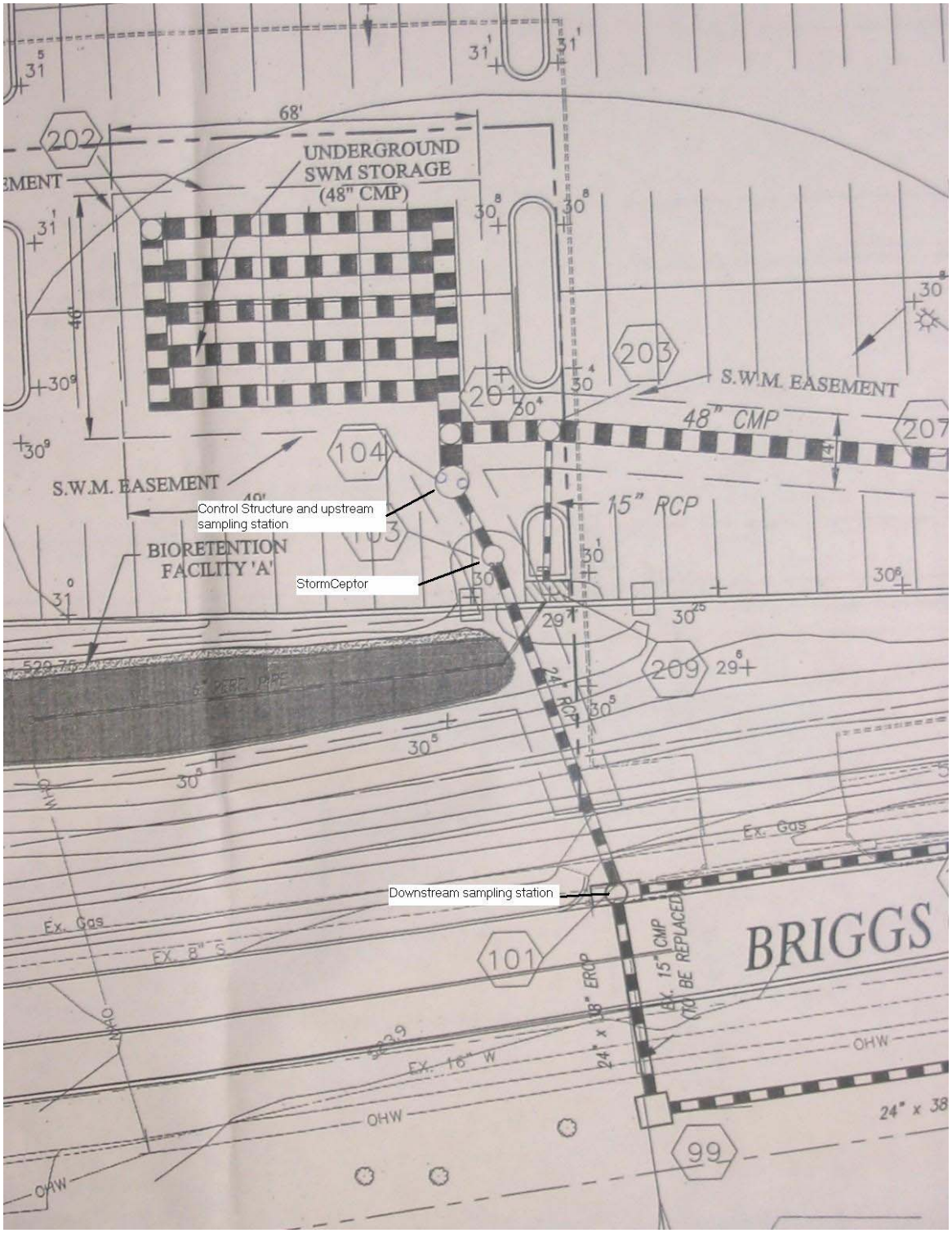


**Figure TA-3.13. Diagram of Cloverly Safeway SWM BMPs with marked sampling locations (2).**

**Table TA-3.19. Detection limits and Maryland water quality standards for chemicals monitored at the Cloverly Safeway Stormceptor®.**

| Parameter | EPA Method | Detection Limit (mg/L) | Maryland Freshwater Acute Criteria (mg/L) |
|---|---|---|---|
| Total Petroleum Hydrocarbons [a] | EPA 418.1 | 2 | None |
| Cadmium | EPA 200.8 | 0.0005 | 0.002 |
| Copper | EPA 200.8 | 0.002 | 0.013 |
| Lead | EPA 200.8 | 0.002 | 0.065 |
| Zinc | EPA 200.8 | 0.025 [b] | 0.12 |
| Total Suspended Solids | EPA 160.2 | 1 | None |

[a] Collected using grab sample method
[b] Zinc detection limit varies between 0.005 and 0.025 mg/L

**Table TA-3.20. Characteristics of storms captured as part of Cloverly Safeway SPA BMP monitoring.**

| Storm Date | Rainfall Quantity (in.) | Rain duration (hr.) | Return interval (yr.) | Preceding drying time (h) | Effluent volume (m3) |
|---|---|---|---|---|---|
| 5/9/2003 | 0.31 | 2 | < 1 | 23.5 | 137.2 |
| 7/28/2003 | 0.69 | 5.92 | < 1 | 14.83 | 634.2 |
| 4/12/2004 | 1.17 | 12 | < 1 | 107 | 947.7 |
| 9/28/2004 | 1.93 | 8 | < 1 | 242.75 | 709.8 |
| 12/9/2004 | 0.56 | 7.5 | < 1 | 38.75 | 550.1 |
| 5/23/2005 | 0.75 | 33.67 | < 1 | 73 | 516.1 |
| 10/27/2006 | 1.55 | 31.17 | < 1 | 159.83 | 1098 |
| 11/7/2006 | 1.66 | 26.5 | < 1 | 131.33 | 958.3 |
| 11/15/2006 | 1.75 | 7.92 | < 1 | 68.92 | 662.2 |
| 11/22/2006 | 1.17 | 27.67 | < 1 | 140.33 | 701 |
| 12/22/2006 | 1.05 | 5 | < 1 | 214.25 | 693 |

**Table TA-3.21. Storm concentrations and loadings of chemicals sampled at the Cloverly Safeway Stormceptor®.**
Loadings were not calculated for total petroleum hydrocarbons (TPH) because this parameter was collected as a "first flush" grab sample. Total suspended solids (TSS) data was not available predating 5/23/2005.

| Storm Event Date | TPH | | Cadmium | | Copper | | Lead | | Zinc | | TSS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet |
| **Analytical Concentration (mg/L)** | | | | | | | | | | | | |
| 5/9/2003 | B.D.L. [a] | B.D.L. | B.D.L. | B.D.L. | 0.012 | 0.012 | 0.003 | 0.003 | 0.13 [†] | 0.12 [†] | n.a. | n.a. |
| 7/28/2003 | B.D.L. | B.D.L. | 0.0061[†] | 0.005 [†] | 0.011 | 0.013 [†] | 0.01 | 0.161[†] | 0.072 | 0.079 | n.a. | n.a. |
| 4/12/2004 | B.D.L. | B.D.L. | B.D.L. | B.D.L. | 0.008 | 0.008 | 0.003 | 0.002 | 0.068 | 0.057 | n.a. | n.a. |
| 9/28/2004 | B.D.L. | B.D.L. | B.D.L. | B.D.L. | 0.01 | 0.008 | 0.003 | 0.003 | 0.037 | 0.034 | n.a. | n.a. |
| 12/9/2004 | 3 | 3 | B.D.L. | B.D.L. | 0.008 | 0.006 | B.D.L. | B.D.L. | 0.039 | 0.029 | n.a. | n.a. |
| 5/23/2005 | 2 | 7 | B.D.L. | 0.0023 [†] | 0.008 | 0.004 | B.D.L. | B.D.L. | 0.062 | 0.034 | 17 | 6 |
| 10/27/2006 | n.s. | n.s. | B.D.L. | B.D.L. | 0.016 [†] | 0.006 | 0.004 | B.D.L. | 0.2 [†] | 0.05 | 140 | 5 |
| 11/7/2006 | n.s. | n.s. | B.D.L. | B.D.L. | 0.006 | 0.005 | B.D.L. | B.D.L. | 0.057 | 0.074 | 9 | 7 |
| 11/15/2006 | 3 | 5 | B.D.L. | B.D.L. | 0.005 | 0.005 | B.D.L. | B.D.L. | 0.062 | 0.056 | 47 | 20 |
| 11/22/2006 | n.s. | n.s. | B.D.L. | B.D.L. | 0.005 | 0.004 | B.D.L. | B.D.L. | 0.071 | 0.057 | 8 | 8 |
| 12/22/2006 | n.s. | n.s. | B.D.L. | B.D.L. | 0.006 | 0.007 | 0.004 | 0.005 | 0.081 | 0.072 | 10 | 10 |
| **Pollutant Loadings (g)** | | | | | | | | | | | | |
| 5/9/2003 | n.c. | n.c. | B.D.L. | B.D.L. | 1.6 | 1.6 | 0.4 | 0.4 | 17.8 | 16.5 | n.a. | n.a. |
| 7/28/2003 | n.c. | n.c. | 3.9 | 3.2 | 7 | 8.2 | 6.3 | 102 | 45.7 | 50.1 | n.a. | n.a. |
| 4/12/2004 | n.c. | n.c. | < 0.5 | < 0.5 | 7.6 | 7.6 | 2.8 | 1.9 | 64.4 | 54 | n.a. | n.a. |
| 9/28/2004 | n.c. | n.c. | < 0.4 | < 0.4 | 7.1 | 5.7 | 2.1 | 2.1 | 26.3 | 24.1 | n.a. | n.a. |
| 12/9/2004 | n.c. | n.c. | < 0.3 | < 0.3 | 4.2 | 3.3 | < 1.1 | < 1.1 | 20.6 | 16 | n.a. | n.a. |
| 5/23/2005 | n.c. | n.c. | < 0.3 | 1.2 | 4.1 | 2.1 | < 1.0 | < 1.0 | 32 | 17.5 | 8773.1 | 3096.4 |
| 10/27/2006 | n.s. | n.s. | < 0.5 | < 0.5 | 17.6 | 6.6 | 4.4 | < 2.2 | 219.6 | 54.9 | 153724.9 | 5490.2 |
| 11/7/2006 | n.s. | n.s. | < 0.5 | < 0.5 | 5.8 | 4.8 | 1.9 | < 1.9 | 54.6 | 70.9 | 8625.1 | 6708.4 |
| 11/15/2006 | n.c. | n.c. | < 0.5 | < 0.5 | 3.3 | 3.3 | < 1.3 | < 1.3 | 41.1 | 37.1 | 31122.1 | 13243.4 |
| 11/22/2006 | n.s. | n.s. | < 0.5 | < 0.5 | 3.5 | 2.8 | < 1.4 | < 1.4 | 49.8 | 40 | 5607.9 | 5607.9 |
| 12/22/2006 | n.s. | n.s. | < 0.3 | < 0.3 | 4.2 | 4.9 | 2.8 | 3.5 | 56.1 | 49.9 | 6929.6 | 6929.6 |

[†] At or above acute criteria value (Refer to Table TA-3.19)

n.c. - Not Calculated (Loadings not calculated since TPH was collected as a "first flush" grab)

n.s. - Not Sampled

n.a. - Not Available

## TA-3.4 Discussion of Structural Monitoring of S&EC and SWM BMPs

There are no technical appendix materials for this section.

## Note to Reader

*For more information on Section 3 or technical appendix materials, please contact DEP at AskDEP@montgomerycountymd.gov, 240-777-7700.*

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